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THE ECONOMIC IMPACTS OF BART CAPITAL AND OPERATING EXPENDITURES

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technical memorandum

The BART Impact Program is a comprehensive, policy-oriented study and evaluation of the impacts of the San Francisco Bay Area's new rapid transit system (BART)

The program is being conducted by the Metropolitan Transportation
nine-county regional agency established by state law in 1970.

The program is financed by the U. S. Department of Transportation,
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ted in the U. S. Department of Transportation.

The BART Impact Program covers the entire range of potential rapid tra
including impacts on traffic flow, travel behavior, land use and urban d
the environment, the regional economy, social institutions and life styles
policy. The incidence of these impacts on population groups, local
economic sectors will be measured and analyzed. Finally, the findings v
preted with regard to their implications for the planning of transportatior
development in the Bay Area and other metropolitan areas.

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THE ECONOMIC IMPACTS OF BART CAPITAL AND OPERATING EXPENDITURES

OCTOBER 1977

TECHNICAL MEMORANDUM

PREPARED FOR

U.S. DEPARTMENT OF TRANSPORTATION

AND

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

WASHINGTON, D.C.

NOTICE

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UNDER CONTRACT WITH THE METROPOLITAN TRANSPORTATION COMMISSION
FOR THE U.S. DEPARTMENT OF TRANSPORTATION
AND THE U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
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16. Abstract

The 71-mile Bay Area Rapid Transit (BART) system is the first regional scale rapid transit system to open in the United States in over 50 years. This technical memorandum assesses the economic impacts of BART's $1.5 billion capital expenditures and $60 million annual operating expenditures on the Bay Area's regional economy.

This memorandum documents the changes in regional output and employment in the nine-county San Francisco Bay Area, in each of 50 sectors, as a result of BART's expenditures. Two input-output models were developed of the San Francisco Bay Area, one for 1967 and one for 1974, to test these impacts. The models and the methodology for formulating them are described.

BART's impact on employment opportunity during construction and its permanent staff is evaluated. The impact of BART's construction expenditures on construction wage rates within the region is also analyzed.

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Metropolitan Transportation Commission

SAN FRANCISCO BAY REGION

CENTRAL AREA

BART: The Bay Area Rapid Transit System

Length: The 71-mile system includes 20 miles of subway, 24 miles on elevated structures and 27 miles at ground level. The subway sections are in San Francisco, Berkeley, downtown Oakland, the Berkeley Hills Tunnel and the Transbay Tube.

Stations: The 34 stations include 13 elevated, 14 subway and 7 at ground level. They are spaced at an average distance of 2.1 miles: stations in the downtowns are less than one-half mile apart while those in suburban areas are two to four miles apart. Parking lots at 23 stations have a total of 20,200 spaces. There is a fee (25 cents) at only one of the parking lots. BART and local agencies provide bus service to all stations.

Trains: Trains are from 3 to 10 cars long. Each car is 70 feet long and has 72 seats. Top speed in normal operations is 70 mph with an average speed of 36 mph including station stops. All trains stop at all stations on the route.

Automation: Trains are automatically controlled by the central computer at BART headquarters. A train operator on board each train can override automatic controls in an emergency.

Magnetically encoded tickets with values up to $20 are issued by vending machines. Automated fare gates at each station compute the appropriate fare and deduct it from the ticket value. At least one agent is present at each station to assist patrons.

Fares: Fares range from 25 cents to $1.45, depending upon trip length. Discount fares are available to the physically handicapped, children 12 and under, and persons 65 and over.

Service: BART serves the counties of Alameda, Contra Costa and San Francisco, which have a combined population of 2.4 million. The system was opened in five stages, from September, 1972, to September, 1974. The last section to open was the Transbay Tube linking Oakland and the East Bay with San Francisco and the West Bay.

Routes are identified by the terminal stations: Daly City in the West Bay, Richmond, Concord and Fremont in the East Bay. Trains operate from 6:00 a.m. to midnight on weekdays, every 12 minutes during the daytime on three routes: Concord-Daly City, Fremont-Daly City, Richmond-Fremont. This results in 6-minute train frequencies in San Francisco, downtown Oakland and the Fremont line where routes converge. In the evening, trains are dispatched every 20 minutes on only the Richmond-Fremont and Concord-Daly City routes. Service is provided on Saturdays from 9 a.m. to midnight at 15-minute intervals. Future service will include a Richmond-Daly City route and Sunday service. Trains will operate every six minutes on all routes during the peak periods of travel.

Patronage: Approximately 142,000 one-way trips are made each day. Approximately 200,000 daily one-way trips are anticipated under full service conditions.

Cost: BART construction and equipment cost $1.6 billion, financed primarily from local funds: $942 million from bonds being repaid by the property and sales taxes in three counties, $176 million from toll revenues of transbay bridges, $315 million from federal grants and $186 million from interest earnings and other sources.

March 1978

SUMMARY AND FINDINGS

One element of rapid transit's impacts on the San Francisco Bay Area is the impact BART's construction expenditures and continuing operating expenditures have had on regional sales, income and employment. This technical memorandum documents a research approach pursued to measure these economic impacts as well as the findings of that research.

The Economic Impact of BART's Capital Expenditures

The cost of building and equipping BART was more than $1.5 billion, of which $1.2 billion was initially spent within the nine-county Bay Area between 1964 and 1976. Any public investment of this magnitude will have a large impact on the economic activity of a region. Input-output analysis of the regional economy indicates that such expenditures would require $3.1 billion of direct and indirect expenditures on goods and services within the nine-county region.

The employment impact, in person-year equivalents, was 30,645 person-years in direct employment. Including indirect employment generated by construction activity, the total was 75,000 person-years.

Since it is assumed these funds would not have been spent by the public sector, except on BART, these expenditures represent a BART impact.

This investment did not affect the gross regional product, the total regional employment, nor personal income in the region, in any year by more than one-half of one percent. In a less diversified economy with underutilized economic resources -- whether plant or labor -- and in a smaller region, the effect of the same magnitude of expenditures on the economy would have been both more visible and relatively more significant.

The largest relative impact of BART's construction was in the percentage of the regional construction work force occupied in the building of BART, which reached nearly six percent of the regional construction force in 1968. Nonetheless, BART construction expenditures had no discernible inflationary impact on the construction wage rate.

During the decade of construction, minority households in the region received nearly $116 million additional income. Nonminority households received over $811 million because of BART capital expenditures.

The impact of BART's capital expenditures (including construction and equipment acquisition) on regional sales and income are summarized by sector in Table 1. Both the direct effects of construction expenditures and the total effects, after all indirect and induced purchases of goods and services in the region, are illustrated. The employment equivalent of these expenditures is also illustrated.

Table 1

IMPACT ON SALES AND INCOMES
OF BART CAPITAL EXPENDITURES 1964-1976
(Millions of 1976 Dollars)

Sector	Direct	Total
Agriculture and Mining	$ 0.000	$ 17.003
Construction	907.656	921.122
Manufacturing	71.461	420.061
Transportation and Utilities	0.980	113.827
Trade	0.000	165.590
Finance, Insurance and Real Estate	9.164	154.399
Services	209.030	421.148
Personal Income	1.651	926.798
Minority	0.347	115.598
Nonminority	1.304	811.200
Total Regional Sales and Income	1,199.940	3,140.088
Regional Imports	263.380	1,220.398
Transfers (Land Acquisition)	60.424	
Total BART Capital Expenditures	$1,523.746	
TOTAL EMPLOYMENT IMPACT IN PERSON-YEARS	30,645	75,009

Source: McDonald & Grefe, Inc.

The Economic Impact of Expenditures on BART's Operations

The continuing expenditures on BART's operations are also large, but insignificant to the regional economy as a whole. The difference in regional transit operating expenditures with BART, over transit operating expenditures without BART, has been estimated at nearly $47 million per year at 1976 service levels. This expenditure has a total direct and indirect impact on regional sales and income of nearly $149 million per year, including an increase of nearly $52 million per year in personal income. The employment equivalent to this total impact is 3,017 permanent jobs within the region.

The operation of BART stimulates the regional economy more than the operation of an all bus alternative (the No-BART Alternative) because the operating expenditures on BART service are greater than those which would be necessary for the bus transit alternative.

The Impact of BART's Expenditures on Employment Opportunity

One of BART's economic opportunities was to use its expenditures as public leverage in improving the potential employment of minorities. During its construction, BART's direct expenditures alone accounted for over 30,000 person-years of work. On-site construction employment during its peak year involved over 5,000 employees. By establishing equal employment standards, BART's construction employment achieved a minority participation rate of 36 percent, significantly higher than the 22 percent participation of minority workers in the regional construction work force.

BART's record in hiring minorities for its permanent staff has also been a positive impact, compared to minority representation in the regional population. Nearly 40 percent of the BART work force is minority, almost twice the representation of minorities in the regional population as a whole.

The experience of women in the BART work force, in comparison with women in other transit agencies, also represents a positive impact. BART has a larger percentage of female employees, and they are better compensated, than other agencies. Further, there are more women in a nonclerical function, including management, at BART than in the other agencies. This impact could reflect the staffing of a new agency during a period when equal opportunity for women has been a highly visible issue.

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I. INTRODUCTION

The Economics and Finance Project of the BART Impact Program is designed to contribute to the understanding of what impacts the construction and operation of rapid transit in the Bay Area have had on the region's economy and public finance. In terms of the region's economy, the project seeks to measure the impacts of expenditures for construction or operation. It also reviews the implications of BART's service on the efficiency of business operations within the region and the competitive advantages of the region in attracting business and commerce. A major aspect of BART's economic impacts, however, is the manner in which BART was financed. The Economics and Finance Project identifies the tax burden of BART's financing, both for construction and operations, and evaluates the impact of construction financing on the cost of borrowing by other public agencies and their willingness to fund other public works projects.

This technical memorandum focuses only on the impacts of spending BART's capital and operating outlays. The impacts of these expenditures on the total regional product -- the sales and income of the region generated by both direct expenditures and indirect expenditures -- have been evaluated through the use of input-output analysis. Two input-output models of the nine-county Bay Area region were developed specifically for this analysis. The methodology permits analysis of employment requirements, by economic sector, and the increases to household income due to BART's construction and operation.

As a public agency responsible for considerable construction employment and permanent employment, BART was in a position to improve employment potential for minorities and women. The impact of BART on employment opportunity objectives has been evaluated through statistical review of racial and ethnic employment profiles of the BART on-site construction force and the construction work force in the region as a whole. Similar data, as well as employment data by sex, have been analyzed for the permanent employment at BART, compared to the permanent employment at other regional transit agencies in the Bay Area. In each case, conclusions were drawn from the statistical analysis, as well as from a program of interviewing contractors, union officials and other agencies.

A frequently cited concern over BART as a construction project was its potential for stimulation of inflationary pressures within the local economy, and the construction sector in particular. Statistical analysis of the wage rate history and the level of BART construction employment within the region were undertaken to measure BART's impact on construction wage rates.

The entire Economics and Finance Project reflects a research approach to measuring the impacts of the difference between BART's expenditures and those that would be required to provide transit in the absence of BART. This difference represents BART's impact. The transferability of the findings, however, is conditioned by BART's alternative, which has been defined as a modest expansion of existing bus service with virtually no capital cost and far less operating cost than BART. Moreover, the study represents an evaluation of a specific rapid transit system which may not be representative of future rapid transit systems, in a region with a strong and diversified regional economy. Thus, the findings must be appreciated in the context in which they were measured.

II. THE RESEARCH APPROACH

The economic impacts of constructing and operating a rapid transit system extend considerably beyond the initial dollar impacts alone. The research approach developed to evaluate the economic impacts of BART's capital and operating expenditures considers the direct and indirect expenditure impacts, the employment opportunity implications of both a major public construction project and permanent staffing of a new transit system, and the impact a major public construction project can have on construction wage rates within the region. These impacts are directly related to expenditures and are quite independent from the impact which BART service might have on the regional economy in terms of attracting industry to the region.

A. Objectives

Five research objectives governed the scope of this study of expenditure impacts on the economy of the nine-county San Francisco Bay Area. Each of these research objectives evaluates an impact, or the difference between constructing and operating BART and implementing the regional transit system which might have occurred if BART had not been built.

The first objective of this study was to assess the impact of BART's construction expenditures on regional sales and income (also known as regional output or gross regional product), the measure of all goods and services produced in the nine Bay Area counties.

This measure of economic activity, the total regional sales and income, includes the initial effects of direct construction expenditures on the regional economy, as well as the indirect impacts of the purchase of regional goods and services required as intermediate products to produce the final product (e.g., an intermediate product for heavy equipment is steel). Further, the approach recognizes that household wages and salaries induce further consumption, augmenting the direct and indirect requirements or impacts. These expenditure impacts -- direct, indirect and induced -- are sometimes referred to as the primary and secondary expenditure impacts. The methodology used in this analysis also computed employment impacts as the average number of person years of employment equivalent to the sales and income impact.

A second objective involved estimating the same types of direct, indirect and induced impacts on sales and income or employment for the difference between the operating expenditures of a

regional transit system including BART and a regional system without BART.

A third objective was to determine the impacts that the construction of BART, as a major public project, had on minority employment opportunities in the construction trades. A fourth objective sought to measure the effect of BART's permanent staffing policies on minority employment opportunity in transit operations.

The final objective was to evaluate any inflationary pressures which might have occurred as a result of the magnitude of BART's capital investment and because of its timing during the substantial economic activity of the late 1960s. This objective specifically called for evaluating any inflationary impact BART may have had on construction wage rates within the Bay Area.

B. Definition of the NBA

All of the objectives involved evaluating the difference between economic events with BART as an element of the regional transit system and a regional transit system without BART.[1] The No-BART Alternative (NBA), to which BART is compared in this research, was defined by the Metropolitan Transportation Commission to involve a capital purchase of only 15 additional coaches and an increase in operating expense of only $13.1 million annually.[2] Transit employment for the No-BART Alternative over the current levels for non-BART operators in the region was projected on the basis of current staffing requirements. An additional 600 staff members would be required to maintain the increased service levels, even from existing fleets, associated with the NBA and the reintroduction of Greyhound service. The existing agencies which would increase

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[1] As a result, although all analysis was based on the difference between BART characteristics and NBA characteristics, the small increase in expenditures on employment required from MUNI, AC Transit and Greyhound to serve the projected NBA patronage results in the difference being similar, in some cases, to BART's expenditures or employment alone. Throughout the text, however, the impact will be defined as the difference between the scenarios.

[2] Metropolitan Transportation Commission, "The No-BART Alternative Financing Plan," February 1977. MTC specified $9.2 million increase in operating costs for AC Transit and MUNI; McDonald & Grefe, Inc. estimated an additional $3.9 million for local Greyhound service, based on 1973 experience, inflated to 1976 dollars.

service to accommodate a share of BART's current ridership included Alameda-Contra Costa Transit District (AC Transit), San Francisco Municipal Railway (MUNI) and Greyhound.

The NBA transit service does not carry the full patronage of BART. In fact, it is hypothesized to carry 16.5 million fewer passengers annually, although a proportion of those BART trips may be induced.

C. Definition of the Region

The research strategy requires a comparison of BART and the type of transportation system which might occur if BART had not been implemented. Just as the definition of the Alternative, the NBA, will have implications for the magnitude of BART's impacts, so will the size of the geographical region used as the context for BART's impacts.

The BART Impact Program selected the nine-county Bay Area as the appropriate definition of the region in measuring the expenditure impacts. This decision recognizes that BART was proposed as a regional system, ultimately to serve nine counties, as early as 1955, with the publication of the Bay Area Rapid Transit Commission report on Regional Rapid Transit. From these early days, propitious effects on the regional economy have been suggested as BART's impact on this region, even if, in the last years before BART's bond issue, the District emerged as a three county district instead of five or six. When the District (or service area) was reduced in size, the description of the system's potential impacts was not reduced commensurately. A proper before and after comparison, which includes expectations, should focus on at least five counties and better nine.

The selection of the nine-county region for the input-output analysis may diminish the relative impact of BART's expenditures compared to regional economic activity, since the nine-county economic activity is larger, quite obviously, than the activity in BART counties alone. On the other hand, the absolute impact of BART's expenditures on the region would be smaller if the region were defined as Alameda, Contra Costa and San Francisco counties only, since any construction or equipment purchases made from firms outside these three counties, but within the other six Bay Area counties, would be considered "imports." It seems more appropriate that any economic activity stimulated in San Mateo, for instance, be considered a regional expenditure impact from BART than for it to be excluded from the impact analysis.

In evaluating the relative impact of BART's construction employment on employment opportunity, the employment data were compared to the work force of the San Francisco-Oakland SMSA, not the nine-county region. This shift in the geographical area is not an inconsistency -- there was no attempt to evaluate the overall impact on <u>regional</u> employment opportunity. The purpose of the

analysis was to review the potential impact of a large public project on the opportunity for employment among minority workers. Thus the focus was on the work force which was most likely to be available to apply for employment -- the work force of San Francisco and Oakland, where both construction contractors and union halls are located.

D. Methodology

Each of the broad expenditure impacts being evaluated -- output and employment, equal opportunity and wage inflation -- requires a different research methodology. Further elaboration of each is contained in the Study Design and the Theoretical Framework for the Economics and Finance Project.[1]

1. Input-Output Analysis of Expenditure Impacts

Various applied models of regional growth and development exist which could be used in evaluating the expenditure impacts of BART. Input-output analysis of the regional economy was selected as the appropriate methodology only after a number of alternative models were evaluated and rejected because of theoretical constraints or infeasibility, given the concerns of time and budget and current availability of data.

a. A Comparison of Alternative Approaches

Three basic analytical tools for simulating the impacts of BART expenditures could be considered: export-base employment models, econometric models and regional input-output models. Each analytical framework has its own set of strengths and weaknesses. This section documents the strengths and weaknesses of each approach and provides a justification for selecting input-output analysis.

The widely-used export-base framework with its simple aggregation of export and ancillary (service) employment is too crude for analysis of the intra-regional, inter-industry impacts of public investment within a region, which is the crux of evaluating BART's impact. Further, the concept of export-induced growth is usually incorporated into the other techniques which were considered.

Following the apparent successes of their larger national counterparts, regional econometric models have become increasingly popular in recent years. The first regional econometric models

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[1] McDonald & Grefe, Inc., "Study Design and Project Implementation Plan, Economics & Finance Project," prepared for the Metropolitan Transportation Commission, July 1976; and McDonald & Grefe, Inc., "Theoretical Framework for the Evaluation of Economic and Financial Impacts of BART," July 1976.

were simply sets of independent, recursive equations which linked key regional variables to their national counterparts.[1] As statistical techniques and data sources improved, modelers were able to capture some interaction between regional variables (rather than simply nation-to-region) in simultaneous equation frameworks. Nevertheless, most econometric models have retained a basically recursive structure, in that they translate changes in variables exogenous to the region into regional impacts.

A nation-to-region recursive structure imposes severe limitations on the use of econometric models alone for simulating regional policy impacts.

In this type of econometric model, the economic variables which regional policymakers can affect (e.g., local infrastructure investment, construction employment, land use) are determined, for the most part, by variables outside the region. On the other hand, variables most affected by local investment policies are those least developed as independent variables in the structure of the model. Severe data limitations at the regional level have hampered efforts to incorporate important regional variables, such as construction or investment, into the structure of regional econometric models.[2]

A second, data-related weakness of econometric models is the high level of aggregation at which impacts are measured. For example, while an econometric model may correctly predict a change in output or employment, it cannot predict who will be affected, where they are located, etc. This is particularly problematic for public officials who are concerned with the distribution of economic impacts, as well as their magnitude.

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[1] "Recursive" refers to the nation-to-region causal structure of the model.

[2] The validity of an econometric model's specification of an interindustry structure is a related issue. If relationships between industries and other economic variables are developed through "trial and error" methods -- as they often are, due again to the lack of data and absence of well-defined theories of regional growth -- it is difficult to determine the theoretical validity of the model. Classical statistical tests of structural coefficients only apply if the model is specified completely a priori and then tested. This is not a real issue for forecasting, if the model is a "good predictor," but if the same model is to be used to predict interindustry effects, the structural assumptions are of crucial importance. For a more detailed discussion of these problems, see Charles Richter, "A Critique of Regional Econometric Models," Annals of Regional Science, 6, No. 1 (1972): 29-34, and William Alonso, Ibid: 134-135.

The real strength of econometric models lies in their ability to forecast key regional variables. Nearly all applied econometric models are specifically designed to provide agency planners with accurate short-term forecasts of key economic variables. For these tasks, simultaneous equation systems have proved eminently suitable. On the other hand, for purposes of analyzing either long-term structural changes or regional development, other theoretical frameworks, such as regional input-output models or dynamic simulation models, may be more appropriate.

The third technique of regional modeling, which has been developing rapidly over the past decade, is input-output analysis.[1]

The primary advantage of the regional input-output model is its ability to specify a detailed regional structure and thereby estimate the indirect and induced impacts of a change in regional economic activity. In addition, when household income and expenditures are made endogenous to the model, the consequences of an economic change can be distributed over social groups (e.g., minority and nonminority household groups). This last characteristic, however, is not unique to input-output models.

Furthermore, input-output models are sensitive to changes in the composition of regional investment expenditures, as well as to their total cost. Even the most elaborate econometric equation systems have only one aggregate regional investment variable (and usually it is measured as a "proxy" for actual investment data). No existing econometric model could discern changes in the relative impact of investment by industry (say, at the two-digit SIC level). In other words, a strictly econometric simulation might predict the same impact on sales and employment for two very different investment projects of the same dollar value. The sensitivity of input-output analysis to these issues resulted in selection of input-output methodology for this project.

Despite these advantages, regional input-output models also have their limitations. First, the input-output model depends upon exogenous final demands (regional exports, government purchases, etc.), hence it is not a long-term forecasting tool. But forecasting was not essential to this research. Measurement of the impacts of known expenditures in a known economy was essent
Secondly, constructing a detailed interindustry matrix from

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[1]For a general description of progress in regional input-output modeling, see Harry W. Richardson, Input-Output and Regional Economics, Wiley & Sons, Inc., New York, 1972.

survey data can be very expensive, although a partial survey technique, described in Appendix A, was devised in an attempt to reduce this problem.

b. A General Description of Input-Output Analysis

This section provides a general description of input-output analysis using an aggregated, eight sector model directed at an audience unfamiliar with input-output analysis. A more detailed description of the methodology used in this project is contained in the next section.

1) Input-Output and Planning Decisions

When faced with alternative possibilities for resource development, it is often useful to determine which project would provide the greatest net benefits for the community. Certain benefits, such as changes in sales and employment, may be measurable while other equally important benefits, such as those affecting social well-being or "quality of life " may be more difficult to measure.

An input-output model provides one method of quantifying and comparing changes in regional sales, income and employment. It is important to note that several planning considerations are outside the scope of this economic model. For example, the implications of a change in land use for local environmental quality, for tax revenues and for the regional distribution of income, are important questions which this particular model cannot predict. However, input-output analysis can be adapted to provide some insight into many of these problems.

2) Constructing the Model

What happens when a local business increases or decreases its sales? Or what happens when an agency increases its purchases (which is the other side of business increasing its sales)? This is the basic question the input-output model sets out to answer.

The first step in constructing an input-output model is to group all economic activities within the region into a fixed set of economic sector groupings. In order to determine the sector classifications and to develop the model, several simplifying assumptions are made:

- Homogeneity: All of the enterprises that are grouped together are assumed to have similar input (purchases of goods and services requirements).

- Linear Production Functions: This implies that on the average the proportion of each sales dollar spent upon each good or service used in production of a particular product will remain the same. In other words, if it takes one cup of flour to make one loaf of bread, it will take two cups of flour to make two loaves of bread (and the price of flour will remain constant).

- Purchasing Patterns Change Slowly Over Time: The technical relationships and trade patterns of this model are based on one year's recorded transactions. Historically, changes in technology, relative prices (as opposed to general inflation), and regional import patterns occur slowly. This allows the same model to be used over a period of years. (National input-output models are developed on five-year intervals.)

The Dollar-Flow Table (Table II-1) provides a description of the circulation of dollars among local sectors. It is based on a tabulation of all sales and purchases for a given year. Each industry group has a column in the table simulating purchases from other regional firms and representing the "recipe" of goods and services (including household labor) necessary to produce that industry's total output. Some columns are completely filled in, indicating direct economic relationships with all the other sectors, while others are only sprinkled with entries, indicating few direct transactions with local sectors. Purchases from firms located outside the region are grouped into the Regional Imports Row (Row #10 in Table II-1) and might be termed "leakages" of local sales dollars. Irrespective of the number of entries each sector's column total (Gross Regional Outlays) matches its row total (Regional Output).

Table II-2 shows how the column and row entries for one sector (Agriculture) can be read. Reading down the column, each entry represents a purchase from a local firm or household (except for the imports and unallocated entries). Reading across the rows, each entry represents a sale by that sector to other firms in the region. Diagonal entries designate a sector's sales "to itself" or within that sector grouping (for example, cotton farmers' sale of seed to other cotton farmers).

The Technical Coefficients Table (Table II-3) possesses the same matrix configuration as the Dollar-Flow Table. Every box having an entry in the Technical Coefficients Table corresponds to the same box in the Dollar-Flow Table. To express the dollar values of the Dollar-Flow Table in technical coefficients multiply the dollar flow by the technical coefficients.

Table II-1

EXAMPLE OF AN AGGREGATED INPUT-OUTPUT TABLE
1974 DOLLAR-FLOW TABLE
(MILLIONS OF 1974 DOLLARS)

	INTERINDUSTRY SALES								FINAL DEMAND			
	1 AGRI-CULTURE	2 CON-STRUCTION	3 MANU-FACTURING	4 TRANS-PORTATION UTILITIES	5 TRADE	6 FIRE[1]	7 SERV-ICES	8 HOUSE	9 INTER-MEDIATE INPUTS	10 REGIONAL EXPORTS	11 INVEST-MENT GOVERN-MENT	12 REGIONAL OUTPUT
1. Agriculture and Agricultural Services	167	0	219	2	0	6	0	10	399	627	0.7	1038
2. Construction and Mining	17	2	13	15	4	39	11	0	103	63	248.1	415
3. Manufacturing	28	46	204	0	7	1	7	133	296	1103	31.1	1564
4. Transport and Utilities	12	8	36	32	21	4	15	88	131	41	23.1	284
5. Trade	36	38	69	6	15	4	14	296	183	269	22.5	772
6. Finance, Insurance & Real Est.	30	5	18	5	30	25	20	242	136	126	7.1	512
7. Services	13	13	21	13	22	11	16	199	112	59	31.2	402
8. Household	323	108	214	112	315	69	209	1				
9. Intermediate Purchases	306	114	584	75	101	92	87	971				
10. Regional Imports	253	139	561	60	98	45	85	702				
11. Unallocated Value Added	154	52	204	36	257	304	21	0				
12. Gross Regional Outlays	1038	415	1546	284	772	512	402	1675				

[1] FIRE -- Finance, Insurance, Real Estate

SOURCE: University of California, Cooperative Extension

Table II-2

READING THE DOLLAR-FLOW TABLE
(Using one row and column from Table II-1)

Agriculture's Purchases from Firms (Rows 1-7)	Agriculture's Sales to Firms (Columns 1-7)	Agriculture's Sales to Households (Column 8)	Agriculture's Sales Outside the Region (Column 10)	Agriculture's Sales to Government (Column 11)	Agriculture's Total Sales (Column 12)
		Households' Purchases from Other Firms (Rows 2-7)			
Agriculture's Purchases of Labor (Wages and Salaries) (Row 8)	Households' Wages and Salaries from Other Firms (Columns 1-7)				
Agriculture's Imports from Outside the Region (Row 10)					
Agriculture's Tax Payments and Depreciation (Row 11)					
Agriculture's Total Purchases (Row 12)					

SOURCE: University of California, Cooperative Extension

Table II-3

EXAMPLE OF AN AGGREGATED 8 SECTOR INPUT-OUTPUT MODEL
TABLE OF TECHNICAL COEFFICIENTS (DIRECT REUIREMENTS)

INDUSTRY SECTOR	AGRICULTURE	CONSTRUCTION	MANUFAC-TURING	TRANSPORT & UTILITIES	TRADE	FIRE[1]	SERVICES	HOUSEHOLDS
1. Agriculture and Agricultural Services	0.16137	0.00186	0.14052	0.01003	0.00091	0.01300	0.00217	0.00620
2. Construction and Mining	0.01709	0.00580	0.00872	0.05290	0.00525	0.07669	0.02820	0.00012
3. Manufacturing	0.02735	0.11110	0.13092	0.00154	0.00951	0.00328	0.01818	0.07998
4. Transport and Utilities	0.01186	0.02087	0.02350	0.11338	0.02753	0.00916	0.03883	0.05279
5. Trade	0.03485	0.09173	0.04417	0.02255	0.02002	0.00815	0.03596	0.17721
6. Finance, Insurance & Real Estate	0.02968	0.01296	0.01209	0.01795	0.03905	0.04884	0.05105	0.14492
7. Services	0.01310	0.03234	0.01375	0.04754	0.02861	0.02218	0.04211	0.11886
8. Household Expenditures	0.31178	0.26144	0.13706	0.39458	0.40825	0.13600	0.52066	0.00068
9. Intermediate Outlays	0.29534	0.27669	0.37371	0.26592	0.13091	0.18833	0.21653	0.58011
10. Imports	0.24430	0.33502	0.35863	0.21427	0.12696	0.08860	0.21239	0.41920
11. Unallocated	0.14858	0.12685	0.13060	0.12523	0.33388	0.59407	0.04942	0.00000
12. Total	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

[1] FIRE -- Finance, Insurance, Real Estate

Source: University of California, Cooperative Extension

Table II-4

EXAMPLE OF AN AGGREGATED 8 SECTOR INPUT-OUTPUT MODEL
TABLE OF DIRECT AND INDIRECT EFFECTS (TOTAL REQUIREMENTS)

INDUSTRY SECTOR	AGRICULTURE	CONSTRUCTION	MANUFAC-TURING	TRANSPORT & UTILITIES	TRADE	FIRE[1]	SERVICES	HOUSEHOLDS
1. Agriculture and Agricultural Services	1.21683	0.03939	0.20607	0.03605	0.02205	0.02719	0.03202	0.03761
2. Construction and Mining	0.03974	1.02438	0.02734	0.08112	0.02638	0.09005	0.05690	0.03135
3. Manufacturing	0.09999	0.18203	1.19811	0.08218	0.07557	0.04327	0.00941	0.13356
4. Transport and Utilities	0.06442	0.07060	0.06559	1.18670	0.08130	0.03601	0.11160	0.10126
5. Trade	0.16024	0.20009	0.13564	0.17042	1.14418	0.07191	0.20296	0.25835
6. Finance, Insurance & Real Estate	0.13926	0.10714	0.08914	0.14519	0.14927	1.10174	0.19793	0.22548
7. Services	0.10090	0.11011	0.07609	0.15657	0.11916	0.06651	1.16334	0.18415
8. Households	0.56619	0.48684	0.36887	0.68331	0.60609	0.26618	0.79993	1.31111
9. Total Multiplier	2.38761	2.22061	2.16688	2.54167	2.22402	1.70289	2.67411	2.28292

[1] FIRE -- Finance, Insurance, Real Estate

Source: University of California, Cooperative Extension

A sector's column in the Technical Coefficients Table depicts that sector's production function (its "recipe" of goods and services needed for production). Each coefficient represents the proportion of total sales that goes to buy factors of production from the row sector. Again, since total sales equal total expenditures, the sum of each column of technical coefficients must equal 1. Notice that there is no significance to a sector's row in the Technical Coefficients Table as there was in the Dollar-Flow Table.

The technical coefficients express a fixed technical relationship existing irrespective of the volume of sector production. The Technical Coefficients Table therefore enables one to estimate the direct impact of a change in a sector's total sales. By multiplying the value of the change in that sector's sales with its technical coefficients (that sector's column in Table II-3, one can estimate the change in direct sector purchases from local sectors.

The last and most important table is the Direct and Indirect Requirements Table (Table II-4). This table presents measures of the direct plus indirect impacts resulting from a change in a sector's sales. Originating out of the Technical Coefficients Table, the Direct and Indirect Requirements Table utilizes each sector's technical coefficients relationships to determine the change in total economic activity resulting from each dollar change in a sector's sales. As the Technical Coefficients Table indicates, for each dollar change in a sector's sales the purchases of inputs also change. This means that other local sectors experience a change in their sales as a result of the initial change. The entries in the boxes of Table II-4 indicate the subsequent change in the row sector's sales originating from a one dollar change in the column sector's sales. Notice that when the row and column sectors are the same, the registered impact is greater than 1. This results from the one dollar initial change (positive or negative) in sales plus additional changes due to changes in purchases by other sectors indirectly affected as the transaction works its way through the system. The summation of all these direct and indirect changes in sales (column totals in Table II-4) is referred to as the sector's multiplier. In general, the greater the interaction with local sectors and the greater the proportion of purchases made locally, the larger the multiplier. Multiplier analysis can be used to estimate direct and indirect impacts on the level of local economic activity of local development alternatives, changes in non-local sector purchases, or government activity.

c. The Bay Area Input-Output Methodology

Two input-output models of the nine-county Bay Area, for 1967 and 1974, were developed specifically for the BART Impact

Program to ensure that models used to evaluate BART's impacts were relevant to the Bay Area and to the key sectors impacted by BART.[1] Developing new models also permitted the measurement of impacts on household income for nonminority and minority households. Two models were developed to permit more accurate simulation of economic impacts from expenditures occurring over an extended period of time, while the structure of the Bay Area economy was changing.

The process for developing an input-output model of a regional economy begins with formulation of a table of the transactions between specific economic sectors during a given year. Thus, the amount of purchases which one sector makes from another in the process of its annual production is recorded (e.g., steel purchases by the auto industry).

The economic sectors were defined for the Bay Area models to reflect those sectors which would most likely be affected by BART's expenditures. Fifty economic sectors and two household sectors (listed in Table II-5) were used for the basic models. Ten subsectors were added to the basic model in evaluating capital expenditures to assure that distinct transaction characteristics of these heavily-affected activities were not lost in the analysis, due to aggregation.[2] For use in testing the impacts of operating expenditures, the transit service sector was expanded to provide distinct treatment of BART, AC Transit, MUNI and Greyhound.[3]

The transactions table, or dollar-flow matrix, was developed using both survey and nonsurvey data collection techniques. Beginning with key sector rows and columns, survey data were obtained from relatively simple industry questionnaires and other primary sources. These data were combined with nonsurvey data on industry coefficients. The result of this methodology is a regional model that is sensitive to local, rather than statewide or national, interindustry structures and is more precise in key sectors most affected by BART construction and

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[1] It is important to recognize that the economic impacts were measured for a nine-county region. The nine-county region was selected for its simulation of the region BART was originally designed to serve, and because of the cohesiveness of the region as an economic entity.

[2] Sectors 53-62 in Table II-1.

[3] See Appendix A for a description of how the subsectors were developed. The source of the subsectors was the 1967 484 order input-output table at Lawrence Berkeley Laboratory.

procurement expenditures. The dollar-flow matrix indicates all of the interindustry flows of goods and services for the region.[1]

The next step in developing an input-output model involves developing a direct requirements matrix, also known as a matrix of technical coefficients, in which the amount of each year's transactions in each cell of the dollar-flow matrix is divided by the total regional output. From this matrix, the Leontief inverse is prepared, which becomes the direct and indirect requirements table, representing the input-output model. This table indicates the value (and its employment equivalence) of the economic activity required from each economic sector to support each additional dollar spent in any of those sectors.

Normally, there are three types of impact for any expenditure. The first is a direct expenditure impact, the next is the indirect impact, which measures the goods and services of intermediate products required to produce the object of the direct expenditure, and the third is the amount of goods and services consumed by household sectors, with the additional income generated by direct and indirect economic impacts. In the tables used for the Bay Area input-output model, the household sectors are endogenous to the model and, therefore, induced expenditures are contained in the direct and indirect requirements table.

Input-output tables were developed for two separate points in time. One table was developed for 1967 and another for 1974. An input-output table identifies the relationship between producing sectors and the goods and services needed for production. The two models were necessary to adjust for structural changes in the economy over BART's construction period, particularly the impact of inflation on the relationship between employment and investment. The 1967 model was used for estimating the impacts of all construction expenditures through and including 1970.

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[1]The methodology and data sources are described in Appendix A to this report. Full documentation of the models is contained in George Goldman, Darryl McLeod, John Mayer, Jr., and Joyce McReynolds, San Francisco Bay Area Input-Output Model, 1967-1974, Berkeley: Cooperative Extension Service, University of California, forthcoming.

The 1974 table was used to estimate the impacts of all capital expenditures from 1971 through 1976, as well as being used to estimate the impacts of operating expenditures. The assumption of the BART Impact Program for measuring BART impacts is that the full-service system would be represented by mid-1976 operations. The data for 1974, which was the most recent available for constructing the second model, was assumed to be representative of regional economic activity and interindustry flows for the final years of construction and for transit operations.

All impacts which are dollar impacts are expressed in current dollars.

d. The Assumptions Governing the Economic Model

In order to prepare and apply an input-output model, several simplifying assumptions must be made regarding the functioning of the regional economy. This section discusses standard input-output assumptions with special reference to limitations they impose upon regional models.

The first step in constructing the input-output table is to group industries into a limited number of well-defined sectors. It is assumed that each sector of the model produces one homogeneous good. This assumption is necessary because the model distributes each sector's output in a fixed pattern (across the rows) to other sectors in the regional economy. This homogeneity assumption becomes more severe at the regional level, because the "mix" of industries which compose each sector may vary greatly between the nation and the region. The purpose of beginning with a model of nearly 400 sectors and aggregating to the 50 sector level is to minimize the inaccuracies in creating regional sectors from national data.

A second and parallel assumption of input-output analysis is that each industry sector uses a fixed combination of factor inputs. In other words, sectors which have similar purchasing patterns ("technologies") are grouped together in the same sector. Again, this assumption is more restrictive at the regional level, because many firms tend to import large portions of their supplies from outside the region. These relatively high import and export proportions account for the widest discrepancy between national and regional purchasing patterns (or technical coefficients). The primary purpose of incorporating the survey data and the transportation commodity flow data was to adjust for the Bay Area's particular regional import-export patterns.

A third assumption of input-output analysis is that each sector experiences constant return to scale or linear production functions.

The use of average employment multipliers based on a constant sales-to-employment relationship is one important aspect of this assumption. If an increase in sales demand were perceived to be temporary, for example, new jobs may not actually be created to meet that demand. The model would project this employment requirement, nonetheless. To some extent, the NBA employment forecasts, projecting the expenditure of increased amounts in operations, may suffer from this limitation. Correction for this phenomenon would decrease the positive employment impacts of BART.

e. Limitations to Input-Output Methodologies

The techniques of input-output analysis were first applied for regional planning considerations in the United States during the early 1950s. These early models were usually constructed as scaled-down versions of the U. S. national input-output model.[1]

Despite economists' use of informed judgment in their attempts to adjust national coefficients, the basic assumption that each region is structured much like a mini-nation has obvious limitations.

As the acceptance of input-output in planning and regional analysis grew, several survey-based models of State regions were constructed during the early 1960s. The existence of these full-survey input-output models gave researchers an opportunity to compare the models generated by the various nonsurvey methods of national coefficient adjustment with the "actual" regional coefficient. The results of these studies were not encouraging. Almost without exception, researchers found the nonsurvey technique did not yield acceptable regional coefficient estimates, when compared with survey-based counterparts.

The full-survey model, however, had its own set of disadvantages, principally the time-consuming and expensive survey process. It soon became evident that the costly and extensive data requirements of constructing a full-survey input-output model could not be justified for most regional planning applications.

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[1] A good example of this generation of models is the Warren Peterson study of the Utah economy in F. T. Moore and J. W. Peterson "Regional Analysis on an Interindustry Model of Utah," Review of Economics and Statistics, 4 (November 1955): 368-383.

Despite this bleak prognosis, several developments during the early 1970s have made the prospects for regional input-output analysis more promising. One improvement is the use of partial survey models, such as the ones developed in this study, which combine less costly survey efforts with improved secondary coefficient adjustment techniques. Preliminary tests of this technique in a metropolitan area for which a survey model had been developed found the particular partial-survey RAS technique (see Appendix A) used here yielded acceptable results.[1]

The other significant development for regional input-output model construction is availability of more detailed sector breakdowns at the national level. Regional models based on the 50-to-100 order models available during the 1950s and early 1960s suffered from an insensitivity to the particular mix of industries present in the region. This study benefited from the use of the 367 and 485 order models presently available for the U. S. National models are also developed from a consistent data base at more regular intervals.

Finally, the efforts of government agencies to provide more standardized consistent data series on the regional level are evidenced by the Bureau of Economic Analysis Regional Data Series, the Equal Employment Opportunity Commission, SMSA Minority Employment Data and the Department of Transportation data on transportation flows which were used in this model. All have become available in the last five years.

2. Minority Employment Opportunity Implications

Two employment impacts of constructing and operating BART are considered important. The first is the amount of employment generated in various economic sectors by BART's expenditures. These are dealt with through the input-output analysis.

The second impact which is of major policy interest to public decisionmakers is the impact which employment practices on a major public construction project can have on employment opportunities for minority workers, both during its construction phase and during its service phase.

Complete data on the racial and ethnic characteristics of employees of BART's construction contractors and subcontractors was not required with the same determination as recent compliance with Equal Employment Opportunity Commission warrants. The

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[1] See W. I. Morrison and P. Smith, "Nonsurvey Input-Output Techniques at the Small Area Level: An Evaluation," Journal of Regional Science, 14, No. 1 (1974): 1-14.

research approach, therefore, had to be based on available data. More complete data were available on BART's permanent staff.

a. Methodology

Two distinct approaches governed evaluation of the impacts of BART expenditures on construction, on workers' opportunity for employment and the impacts of operating expenditures. The first approach was primarily a data collection task describing general construction employment during the heaviest period of construction, 1967 to 1971, minority construction employment within the region and within BART's work force, and a summary of BART minority construction employment by craft and skill level for the same period. These data, however, represent only a sample of on-site construction workers. The validity of the data is indeterminate although the results are plausible.

A limited program of interviews was conducted with personnel officers and labor union representatives who were involved in the hiring programs for BART's construction. This interviewing program sought to identify, on the basis of the statistical data, differences in the employment patterns of BART's construction and other construction activity which might have occurred for transportation improvements in the absence of BART.

The methodology which was pursued to determine the employment opportunity associated with BART's permanent hiring practices also involved an initial evaluation of the statistical data on employment practices of BART and other transit properties in the region during 1976. To increase the dimensions of this analysis, particularly into advancement opportunities, the statistical analysis was complemented by a case study method of comparison. A random sample of 60 minority BART permanent employees was taken with the intention of gaining each sampled employee's approval to write a short employment history from confidential files. The narrative histories, including advancement, job description and salary, were to provide the basis for interviews with personnel officers or affirmative action officers at other transit operators in the area, i.e., AC Transit, San Francisco MUNI and Greyhound. The personnel officers were asked to review the employment histories and to comment on whether the employee would have fared better, the same, or less well, if he or she had been employed by one of these transit agencies which would have comprised the system in the absence of BART.

Of these 60 permanent employees selected from the San Francisco Bay Area Rapid Transit Employee Detail Reference List,[1] 21 were Black, 14 Oriental, 21 Spanish-American and the remaining four fell into other non-white ethnic categories. This random sample was taken from the 40 percent of the 1,865 BART permanent employees who were classified as minorities. Four females and nine males gave their permission to have employment narratives written: four Black, two Oriental and seven Spanish-American.[2] The low level of response was the result of contract negotiations which were underway, and a strong desire to keep personal information confidential. Interviews were structured through a standard interview guide.[3]

b. Limitations

The limitations of the research approach in determining the impacts of the construction program on employment opportunity include the absence of wage level and job classification information. Nevertheless, the conclusions to be drawn from the available data provide a convincing explanation of the employment opportunity impacts of a major public works project, such as transit construction. The additional data on wage level, skill level and job classification would have permitted a more sector-specific analysis. Future transit projects may wish to maintain these, where they are not already available from EEO 4 data files.

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[1] BART, "Personnel Report No. A06550", March 31, 1976.

[2] Since the interviewing approach was one based not on seeking a statistically justifiable sample and response, but on provision of focused examples to elicit the judgment of personnel officers involved daily with questions of employment opportunity, wages and experience levels, the additional case studies which might have occurred with a higher response rate were not required by the research objectives.

[3] The interviews were conducted with Mr. George Newkirk, Affirmative Action Officer, San Francisco MUNI; Mr. Rene Thompson, Equal Employment Officer, Golden Gate Bridge, Highway and Transportation District; John Rose, Affirmative Action Officer, AC Transit District. All interviews were conducted during the month of June 1976. The interview guides are contained in a Working Note by Dukes-Dukes Associates, Inc., "The Impacts of Constructing and Operating BART on Employment Opportunity," Berkeley: Metropolitan Transportation Commission, August 1976. The minority employee case studies remain confidential to avoid disclosure problems.

3. Construction Wage Rate Effects

One hypothesis suggests that a major public works project can have a substantial inflationary effect on an active economy, particularly in the sector most immediately affected, construction. If this were true, it could have a countervailing impact on public policy objectives to curb inflation; it could also increase the construction cost of all other public projects in the area. The research plan called for measuring the impacts of BART's construction on construction wage rates, as an early symptom of this inflationary phenomenon. The methodology which was used recognizes that secular inflation may occur from the pressures inherent in an expanding money and credit supply. BART's construction impact on wage rate, on the other hand, was more likely to cause "bottleneck" inflation, in which the scarcity of workers causes wage rates to be bid upward.

a. Methodology

There are two ways to look at the question of the impact of BART's construction expenditures on Bay Area construction wages. One involves examining the trend in wages before, during and after BART construction in the San Francisco-Oakland area and other cities. Was there a detectable difference during the BART years in San Francisco and Oakland, either in a time series sense or compared to national or west coast cities?

The second method estimates the relationship between construction employment and the change, over the years, in the local average construction wage. Then, comparing BART to the No-BART Alternative, what was the additional construction employment produced by BART? Additional employment would be considered to estimate the effect on wages of the BART impact on construction employment.

The usual wage increase can be broken down into three parts. The first part is inertia; the usual wage increase in a low (early 1960s) inflation period. The second part is the inflationary segment, which is the part of the change in wage rate caused by the high inflation of the late 1960s and early 1970s. The third part of a wage increase is that part caused by supply and demand considerations. If these last changes are large enough, they can subordinate the increments caused by the first two factors.

The regression framework which was used attempts to quantify the previous factors and place them into a statistical framework.

The dependent variable is the rate of average change in wages in the San Francisco-Oakland area in the heavy construction (SIC 16) sector of the economy. This is a function of a constant term and two independent variables. The constant term is associated with the first component in wage changes, the "inertia" effect assumed to be associated with increases in productivity.

The first independent variable is the change in heavy construction employment, lagged one year, in the State of California. This is a proxy for supply and demand conditions. If this variable is increasing, demand for labor is increasing, putting pressure on the wage rate to rise. The second independent variable is the change in the national average contract construction wage rate. This variable reflects not only the national increases in wage rates in construction, but also inherently responds to the effects of the increasing rates of inflation of the late 1960s and 1970s.[1]

The relationship between changes in the San Francisco-Oakland area heavy construction wage rate and changes in the level of employment is described by the regression equation:

$$Y_1 = 1.7828 + .1757\ X_1 + .4068\ X_2$$
$$r^2 = .4284$$

where Y_1 is the real dollar percent change in wages in SIC 16 in the San Francisco-Oakland area, and where X_1 is the percent change in the State of California.

Heavy construction employment in this equation is lagged one year and X_2 is the real percent change in the national contract construction wage rate.

This model implies that the higher the level of statewide employment and national construction wage rate increases, the higher the San Francisco-Oakland construction wage rate increase. If it is assumed that the BART construction employment was a net increase in heavy industry construction in the State of California over what would have happened if there had been no BART, then the increase in wage rates can be estimated using this equation.

Construction labor market factors were also investigated to corroborate any statistical findings. An examination of transit

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[1]Constant dollar rates of pay increases generally declined during this period. Regressions run with a time trend variable as one of the independent variables have negative coefficients on this variable.

construction employment determined the effects BART construction employment had on labor supply and demand. Interviews with contracting officials and labor officials corroborated conclusions on the causal mechanisms for any statistical evidence of a BART impact on construction wage rates.

b. Limitations

In general, BART construction seems to have had little, if any, effect on wage rate changes in the San Francisco-Oakland SMSA. This investigation centered on the sector most likely to be affected, the heavy construction sector. Although the proportion of employment in this sector related to total BART construction in the San Francisco-Oakland SMSA was not trivial, the effect on wage rates, if any, was minimal.

In terms of applications of this result to other areas, the relevant factors must be considered. What is the labor supply? How much other heavy construction activity is occurring within the relevant area? With BART, these factors did not produce a significant effect on wages.

Furthermore the standard caveat of regression analysis must be applied. The analysis identifies association only, not causality.

III. THE STRUCTURE OF THE REGIONAL ECONOMY

The structure of the regional economy of the nine-county Bay Area has certain characteristics which condition the magnitude of the impact of BART's construction and operating expenditures, as well as being highly relevant to the transferability of findings from this study. This section describes the characteristics of the economy and the interindustry flows within the region which are the substance of the regional input-output model.

A. Description of Regional Economy

Both the type and the magnitude of the economic impacts which a region will experience are determined by the object of an expenditure and the nature of the economy in which it is spent. The transferability of any findings from this study will depend, to some extent, on similarities with the nine-county Bay Area.

The Bay Area nine-county region was selected by the BART Impact Program, in its original research plan, as the appropriate regional definition in measuring the expenditure impacts on the regional economy. The nine-county region consists of four distinct SMSAs, which together provide the Bay Area with a reasonably well-balanced and broader mix of industries than even the national profile.

- The San Francisco-Oakland SMSA is an older, mature economic unit with heavy concentrations of professional services, finance services, insurance and real estate activities. The manufacturing sector in this SMSA, on the other hand, is relatively small (only 19 percent of the SMSA's employment in 1973) and is slow growing. In 1972 a special census ranked this SMSA as the tenth largest administrative and auxiliary metropolitan area in the country. This SMSA also reported the third highest per capita income among SMSAs in 1969. The attributes are equally true for the not-quite coterminous BART District.

- The San Jose SMSA represented the fastest growing manufacturing center in the country during the decade 1960-1970. By 1970, one-half its manufacturing employment was in electronics, which had grown 30 percent during that decade. With the exception of Detroit, the 41 percent of its employment which was engaged in manufacturing activity was the highest in the nation.

- The Santa Rosa SMSA and Vallejo SMSA are less developed economically. They are dominated by suburban light industrial and agricultural activity.

The mix of economic activities also has an effect on the percentage of local household expenditures which initially stay in the region, because of the availability of local goods or services. On the average, in 1974 sixty-three cents of every dollar spent by households stayed within the regional economy in its initial impact. Fifty-six cents of each dollar spent by manufacturing sectors stayed initially in the region and eighty-eight cents of each dollar spent by service sectors stayed within the regional economy initially.

One indication of the economic profile is provided by the percentage of wages and salaries earned in each SMSA, and the region as a whole, in the major economic sectors. Table III-1 summarizes these data for 1975. Although comparable national data were only available for 1970, the comparison of industrial location in the Bay Area and the nation is illustrated in Table III-2.

In 1974, 2.6 percent of the nation's total employment was within the Bay Area. The economic activities which dominate include manufacturing, food processing and high-technology industries such as aerospace and electronics. The area has also played a traditional headquarters role for the oil industry, the financial institutions, the paper industry and regional federal offices.

Table III-3 indicates the employment level in the dominant regional industries. In terms of gross regional product, 40 percent originated in manufacturing industries, a proportion that is very close to the nation's as a whole.

Table III-3

EMPLOYMENT IN DOMINANT INDUSTRIES, 1970
SAN FRANCISCO BAY AREA

Industry	Employment
Electrical Equipment	65,000
Food Processing	55,000
Primary, Fabricated Metals	40,000
Printing and Publishing	36,000
Nonelectrical Machinery	31,000

Source: U. S. Department of Commerce

Table III-1

1975 WAGE AND SALARY INCOME
BY INDUSTRY SOURCE
BAY AREA SMSAS

Economic Sector	Nine County Region	San Francisco-Oakland SMSA	San Jose SMSA	Santa Rosa SMSA	Vallejo SMSA
Manufacturing	21%	15%	38%	15%	11%
Construction	6%	6%	5%	7%	4%
Transp-Utilities	9%	11%	4%	6%	4%
Trade	17%	18%	14%	20%	12%
Fire	7%	8%	3%	6%	2%
Services	19%	19%	20%	17%	12%
Government	20%	21%	15%	23%	51%
Mining, Other	0.8%	1%	1%	6%	4%

Source: U.S. Department of Commerce, Bureau of Economic Analysis

Table III-2

DISTRIBUTION OF 1970 EMPLOYMENT AMONG ECONOMIC ACTIVITIES
SAN FRANCISCO BAY AREA 9-COUNTY REGION
COMPARED TO THE NATION

	San Francisco Bay Area	Nation	Location Quotient[1]
Construction	5%	6%	0.9
Manufacture	19%	25%	0.77
Transp.-Comm.	9%	7%	1.30
Trade	20%	20%	1.0
Fire	7%	5%	1.4
Services	29%	25%	1.14
Business	4%	3%	1.40
Professional	20%	14%	1.23

[1]The location quotient is the local share divided by the national share.

Source: U.S. Department of Commerce, Bureau of Economic Analysis

Per capita income within the region during the period of BART's construction was also relatively high. At $5,000 per annum in 1970, it was 36 percent higher than the national average and 10 percent higher than the State average. By 1974, it was estimated that 15 percent of personal income went to minority households.

A number of specific characteristics of the Bay Area economy were influential in determining the extent and type of BART capital impacts. The size of the regional economy relative to construction and procurement expenditures, for instance, was responsible for minimizing the impact of BART's capital expenditures. Table III-4 illustrates the relative size of these expenditures.

Table III-4

RELATIVE MAGNITUDE OF BART CAPITAL EXPENDITURES

Year	Direct Outlays	Percent of 1967 GRP	Percent of 1967 Construction Sales	Percent of 1967 Manufacturing
1968[1]	$136.07 million	0.5%	5.0%	0.1%
1967	$ 69.43 million	0.3%	2.6%	0.02%

[1]Peak year.

Source: McDonald & Grefe, Inc.

Another characteristic which affects the regional impact is the propensity of local firms to import inputs used in construction or the production of construction materials. Despite the general diversity of the economy and the relatively high proportion of each dollar spent retained in the region, certain construction activities are an exception. For instance, although BART was able to purchase nearly all steel or nonferrous products from local firms, the nonferrous metal industry in the Bay Area imports nearly 80 percent of its materials. Overall, in 1974, the construction industry spent 38 percent of each revenue dollar outside the region. A more specialized or smaller region may experience an even higher leakage effect. And for each dollar spent to purchase goods that are imported into the region, that dollar is lost from the regional sales and income effect.

On the other hand, construction of a transit system in a region with manufacturing capability for rolling stock or control systems would gain a regional impact that BART did not experience, as manufacturing occurs inside the region.

The location of contractors and manufacturers will obviously influence the overall impact. The Bay Area has a large number of national and international construction firms. Sixty-four percent of all construction contracts were awarded to regional firms. Despite the large number of electronics firms within the region, however, 77 percent of the procurement costs for high-technology equipment were awarded to firms outside the region.

IV. THE DIRECT AND INDIRECT IMPACTS OF CAPITAL EXPENDITURES ON REGIONAL OUTPUT, EMPLOYMENT AND INCOME

The most significant immediate economic impact of implementing a rapid transit system involving a fixed guideway is the impact of construction expenditures. The cost of building rapid transit can rival most other large public works projects in dollar magnitude. In this section, the impacts of capital expenditures on the regional economy - both the direct and indirect impacts of these expenditures -- are described.

The impact on regional output, employment and income are measured with the regional input-output model. Two secondary impacts are also evaluated: first, the impact of a major public construction project on employment opportunities for minorities and, second, the impact of a project of this magnitude on construction wage rates.

A. The Cost of Building and Equipping BART (Direct Expenditures)

The cost of building and equipping BART was estimated at $972 million in 1962. For a substantial number of reasons, not least that BART was leading the way in a new technology of rapid transit, as well as delays experienced in an era of unprecedented inflation, the capital costs have increased until the estimate of the cost is now cited as over $1.5 billion. And this total does not include over $714 million in interest on the construction bonds or the $55 million in interest on revenue bonds.

While it might be argued that some of the improvements to the system, even now being planned, are part of the capital cost of BART, for purposes of this analysis, the cost reflected in major construction contracts to date and the records of the Bay Area Rapid Transit District as of June 1, 1977 have been considered complete. These total costs, allocated to sectors for use in the modeling process, are summarized in Table IV-1.[1]

The impact of BART's capital expenditures on regional output, employment and income is a function of the magnitude of the expenditures and the proportion of the expenditures which result in purchases of goods or services produced within the region.

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[1] One known cost, clearly a BART impact, which has not been attributed to the construction of BART in this analysis -- although it should be -- is the BART Impact Program. This research project, funded for a total of $7.5 million to date (almost $3.6 million to consultants) has had a $23.7 million impact on total regional sales and income, and a direct employment equivalent alone of 294 person years.

Table IV-1

TOTAL BART CAPITAL COSTS BY SECTOR
(In Millions Of Dollars)

1.	AGRICULTURE AND MINING	0.000
2.	NEW RESIDENTIAL CONSTRUCTION	0.000
3.	NEW BUILDING CONSTRUCTION	153.410
4.	NEW UTILITIES CONSTRUCTION	18.600
5.	NEW HIGHWAY CONSTRUCTION	116.510
6.	NEW CONSTRUCTION ALL OTHER	466.790
7.	MAINT. AND REPAIR CONSTRUCTION	1.906
8.	ORDINANCE	0.000
9.	FOOD PROCESSING	0.000
10.	TEXTILE PRODUCTS	0.000
11.	LUMBER AND WOOD PRODUCTS	0.000
12.	FURNITURE PRODUCTS	0.000
13.	PAPER AND ALLIED PRODUCTS	0.000
14.	PRINTING AND PUBLISHING	0.000
15.	CHEMICALS AND PLASTIC PRODUCTS	0.000
16.	PETROLEUM REFINING	.020
17.	RUBBER AND LEATHER PRODUCTS	0.000
18.	STONE AND CLAY PRODUCTS	6.690
19.	PRIMARY IRON AND STEEL	0.000
20.	PRIMARY NON-FERROUS METALS	8.980
21.	METAL CONTAINERS	0.000
22.	FABRICATED METAL PRODUCTS	29.170
23.	MACHINE SHOP PRODUCTS	.140
24.	OTHER FABRICATED METAL PRODUCT	1.550
25.	CONST. AND MATERIALS HANDLING	1.600
26.	METAL WORKING EQUIPMENT	0.000
27.	GENERAL INDUSTRIAL MACHINERY	.080
28.	OFFICE AND COMPUTING MACHINERY	9.080
29.	SERVICE INDUSTRY MACHINES	1.250
30.	ELECT. TRANSMISSION EQUIP.	4.440
31.	OTHER ELECTRICAL EQUIP.	.021
32.	COMMUNICATION EQUIPMENT	2.340
33.	ELECTRONIC COMPONENTS AND EQUI	0.000
34.	MOTOR VEHICLES AND EQUIPMENT	.130
35.	AIRCRAFT AND PARTS	0.000
36.	OTHER TRANSPORTATION EQUIP.	.010
37.	SCIENTIFIC INSTRUMENTS	.080
38.	MISCELLANEOUS MANUFACTURING	5.880
39.	TRANSPORTATION AND WHAREHOUSIN	.980
40.	COMMUNICATIONS	0.000
41.	ELECT. AND GAS UTILITIES	0.000
42.	WHOLESALE AND RETAIL TRADE	0.000
43.	FINANCE AND INSURANCE	.943
44.	REAL ESTATE AND RENTAL	8.221
45.	PERSONAL SERVICES	0.000
46.	BUSINESS SERVICES	3.460
47.	AUTOMOBILE REPAIR AND AMUSEMEN	0.000
48.	MEDICAL AND NON-PROFIT SERVICE	0.000
49.	GOVERMENT ENTERPRISES	0.000
50.	PUBLIC TRANSIT FACILITIES	0.000
51.	MINORITY INCOME	.347
52.	NON-MINORITY INCOME	1.304
53.	***LANDSCAPING SERVICES	4.380
54.	***STATION CONSTRUCTION	47.250
55.	***SERVICE FACILITIES CONST.	4.900
56.	***OFFICE BUILDING CONSTRUCTIO	4.790
57.	***RAIL CONSTRUCTION	70.820
58.	***BARTD OPERATIONS	5.240
59.	***TRANSIT SYSTEM MAINT. AND R	2.770
60.	***PROFESSIONAL AND ADMIN. SER	195.950
61.	***UTILITIES MAINT. AND REPAIR	18.600
62.	***LT. RAIL TRANSIT CONSTRUCTI	1.310

Source: McDonald & Grefe, Inc.

Providing these categories of data on the BART experience is no simple task. The contract tabulation upon which this study is based was taken from a Technical Memorandum by the Metropolitan Transportation Commission, an early study of the impact of BART on Bay Area employment, and independent tabulation of the contract files at the Bay Area Rapid Transit District.[1] Research into individual construction contracts, the location of the firm awarded the contract, the contract amounts, and the date of the expenditures, was essential to estimating the economic impacts. Without this information, the regional allocation of direct expenditures and the year of payment would have been impossible to determine.

Where it was possible to establish the date of payment of portions of the services required under contracts, the payments were placed in the year in which they were made. Where this information was not available from current BART files, the start-up date of the contracts cited in the MTC Technical Memorandum was used, with an assumed three-year period of payment and completion, based on the typical payment histories and interviews with construction contractors.

The total contract amounts estimated for each year of the construction period 1964 through 1976 are summarized in Table IV-2. Allocating the contract totals to the year is important in determining which of the two input-output tables would be used in estimating employment impacts. Since the 1974 table reflected inflationary pressures which occurred in the early 1970s, the employment multipliers were lower per dollar in those later years (expenditures from 1971 through 1976 were evaluated from the later table). The total in Table IV-2, approximately $1,524 million, represents the total capital cost in current dollars used for this research.[2]

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[1] See "Capital Costs of the San Francisco Bay Area Rapid Transit System," a Technical Memorandum prepared by Frederick Merrick and Peat, Marwick, Mitchell & Co. for the Metropolitan Transportation Commission, November 1977; and "The Impact of a Public Capital Formation Project on San Francisco Bay Area Employment," by Meida Pang, Graduate School of Business Administration, University of California, Berkeley, June 1973.

[2] Merrick and Peat, Marwick, Mitchell & Co. cite a total capital cost of $1,522 Million. The difference of $2 million between their estimate and the estimate used in this analysis is less than one-eighth of one percent of the total estimated expenditures, an acceptable statistical discrepancy. It may be accounted for partially by the assumption in this study that all general and administrative expenses at BART were capital costs until 1972, after which they were first (and totally) classified as operating expenses.

Table IV-2

BART CAPITAL EXPENDITURES BY YEAR
(In Current Dollars)

Year	Amount	Percent of Total
1964	$ 1,404,755	.09%
1965	46,606,037	3.06
1966	158,456,585	10.40
1967	144,187,060	9.46
1968	244,734,060	16.06
1969	292,772,942	19.21
1970	159,835,914	10.49
1971	130,470,342	8.56
1972	101,129,628	6.64
1973	90,008,873	5.91
1974	85,488,873	5.61
1975	67,274,135	4.41
1976	1,605,455	.11
TOTAL	$1,523,942,666	100.00%

Source: McDonald & Grefe, Inc.

The total amount of all significant BART construction or procurement contracts by contract number allocated to the year of expenditure is contained in Appendix B. This appendix also contains a further definition of all contracts which were received by firms located within the region (regional construction or procurement contracts), hence considered 100 percent changes in regional sales. In any case, where the contract was with a firm which was located outside of the region (for a joint venture, if any of the partners were outside of the region), it was considered an extraregional (i.e., out-of-the-region) construction or procurement contract.

In the case of extraregional contracts, an assumption was made on the percentage of those dollar amounts which were spent as direct expenditures within the region. In the case of construction contracts, it was assumed that 75 percent of the value was spent within the region for local employment and material, regardless of the contractor's headquarters location. In the case of procurement contracts, only 10 percent were assumed to have resulted in a regional expenditure, since the majority of

the technological equipment required by BART was manufactured and assembled outside the region. These estimates were supported in union and contractor interviews conducted as part of this study and the preparation of input-output models to evaluate transportation investments in other regions of the county.

Even when a direct expenditure is 100 percent local, the import sector will absorb 30 to 40 percent of the total sales impact as intermediate goods are purchased or produced outside the region, based on the industry flow survey results.

Allocating direct expenditures to firms inside and outside the region yielded total regional expenditures, by year, summarized in Appendix B. The total regional direct expenditures, for purposes of this analysis, were estimated at nearly $1.2 billion, or 79 percent of the total capital cost.[1]

The assumptions relating to the percentage of the contracted expenditures spent inside the region are crucial to measuring the regional expenditure impacts. These assumptions were made only after thorough review of available data on interindustry flows in the Bay Area and elsewhere. If there is an error in these assumptions, it may be in overestimating the regional component.

The nature of impact analysis behooves consideration of the capital costs of more than BART alone. Since an impact represents the difference between two events, measuring the impact of BART's capital expenditures involves reducing the cost of BART by the amount of the capital expenditures which would have been associated with the No-BART Alternative (NBA), the transit system which would have existed today in the absence of BART.

The capital cost associated with the No-BART Alternative was specified as the cost of 15 additional coaches, all of which would have been built outside of the region. Therefore, they would have appeared in the import sector in the input-output analysis, with no effect on the regional economy (other than in terms of operating costs, which are treated elsewhere). As a result, the total cost of building BART has been assumed to be the BART impact as well, i.e., the difference between BART and the NBA.

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[1]The regional allocation of all contracts totals $1.164 billion. The input-output analysis was conducted with direct expenditures of $1.199 billion to accommodate interagency agreements and other costs not accounted for in Appendix C.

B. Regional Output Effects

Nearly $1.524 billion were spent, and 79 percent of that total is estimated to have been spent directly in the region. That $1.2 billion, over a 12-year period, required total sales and income of $3.1 billion to support the construction and procurement activity. No other single project in the Bay Area during that period (or, perhaps, in history) had generated so much economic activity in a single decade. While in absolute dollars this is a significant infusion of capital for a region, the size of the regional economy reduces its relative impact.

Table IV-3 illustrates the direct and total regional sales and income impacts on the region's economic sectors.

The direct expenditure impacts are in the predictable sectors: construction, maintenance, stone, metals, business equipment and services, and real estate. The total requirements reflect all the intermediate purchases for the construction and procurement activity, but also all the consumer purchases from a work force employed for 75,000 person-years. Thus, large impacts of BART's construction are experienced in the purchase of motor vehicles or retail trade, amusement and medical services, all induced expenditures from household income earned through the direct or indirect requirements of BART's construction.

C. Regional Employment Effects

BART's construction and procurements also had a large positive impact on employment within the region over the 12-year implementation stage. The direct requirements for BART were equivalent to nearly 31,000 person-years of employment. The indirect employment requirements raise the total regional employment impact to over 75,000 person-years. Again, it is unlikely any other single project in the Bay Area's history has had this large an impact within a single decade.[1]

This construction work force, while seemingly large, was not a major proportion of the regional construction employment, which hovered near 90,000 throughout the sixties. In the peak construction year, 1968, BART required 5,000 workers. Thus BART employed many, but did not tax the available labor force over its previous levels. The impact of BART may have been to diminish unemployment in a period of hesitation in the economy.

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[1]These figures cannot be translated simply into jobs, however. In construction contracting, employment tenure can last from a matter of weeks to years; without knowing the distribution of the workers' length of employment, it is not possible to estimate the number of individuals employed for the person-years equivalence.

Table IV-3

REGIONAL OUTPUT EFFECTS
FROM BART CONSTRUCTION AND EQUIPMENT 1964-76
(In Millions Of Dollars)

SF BAY I-O SECTOR DESCRIPTIONS	DIRECT	TOTAL
1. AGRICULTURE AND MINING	0.000	17.003
2. NEW RESIDENTIAL CONSTRUCTION	0.000	0.000
3. NEW BUILDING CONSTRUCTION	153.410	153.410
4. NEW UTILITIES CONSTRUCTION	18.600	18.600
5. NEW HIGHWAY CONSTRUCTION	116.510	116.510
6. NEW CONSTRUCTION ALL OTHER	466.790	466.790
7. MAINT. AND REPAIR CONSTRUCTION	1.906	15.372
8. ORDINANCE	0.000	.390
9. FOOD PROCESSING	0.000	71.817
10. TEXTILE PRODUCTS	0.000	10.197
11. LUMBER AND WOOD PRODUCTS	0.000	0.000
12. FURNITURE PRODUCTS	0.000	3.960
13. PAPER AND ALLIED PRODUCTS	0.000	10.947
14. PRINTING AND PUBLISHING	0.000	13.649
15. CHEMICALS AND PLASTIC PRODUCTS	0.000	20.705
16. PETROLEUM REFINING	.020	35.825
17. RUBBER AND LEATHER PRODUCTS	0.000	7.367
18. STONE AND CLAY PRODUCTS	6.690	53.258
19. PRIMARY IRON AND STEEL	0.000	11.637
20. PRIMARY NON-FERROUS METALS	8.980	12.691
21. METAL CONTAINERS	0.000	4.025
22. FABRICATED METAL PRODUCTS	29.170	63.088
23. MACHINE SHOP PRODUCTS	.140	2.319
24. OTHER FABRICATED METAL PRODUCT	1.550	11.535
25. CONST. AND MATERIALS HANDLING	1.600	4.353
26. METAL WORKING EQUIPMENT	0.000	.589
27. GENERAL INDUSTRIAL MACHINERY	.080	3.381
28. OFFICE AND COMPUTING MACHINERY	9.080	11.808
29. SERVICE INDUSTRY MACHINES	1.250	3.227
30. ELECT. TRANSMISSION EQUIP.	4.440	7.177
31. OTHER ELECTRICAL EQUIP.	.021	4.914
32. COMMUNICATION EQUIPMENT	2.340	8.689
33. ELECTRONIC COMPONENTS AND EQUI	0.000	2.463
34. MOTOR VEHICLES AND EQUIPMENT	.130	27.762
35. AIRCRAFT AND PARTS	0.000	.108
36. OTHER TRANSPORTATION EQUIP.	.010	.807
37. SCIENTIFIC INSTRUMENTS	.080	2.248
38. MISCELLANEOUS MANUFACTURING	5.880	9.129
39. TRANSPORTATION AND WHAREHOUSIN	.980	61.828
40. COMMUNICATIONS	0.000	21.379
41. ELECT. AND GAS UTILITIES	0.000	30.620
42. WHOLESALE AND RETAIL TRADE	0.000	165.590
43. FINANCE AND INSURANCE	.943	62.378
44. REAL ESTATE AND RENTAL	8.221	92.021
45. PERSONAL SERVICES	0.000	25.021
46. BUSINESS SERVICES	3.460	79.026
47. AUTOMOBILE REPAIR AND AMUSEMEN	0.000	45.162
48. MEDICAL AND NON-PROFIT SERVICE	0.000	54.195
49. GOVERMENT ENTERPRISES	0.000	10.920
50. PUBLIC TRANSIT FACILITIES	0.000	1.254
51. MINORITY INCOME	.347	115.598
52. NON-MINORITY INCOME	1.304	811.200
53. ***LANDSCAPING SERVICES	4.380	4.380
54. ***STATION CONSTRUCTION	47.250	47.250
55. ***SERVICE FACILITIES CONST.	4.900	4.900
56. ***OFFICE BUILDING CONSTRUCTIO	4.790	4.790
57. ***RAIL CONSTRUCTION	70.820	70.820
58. ***BARTD OPERATIONS	5.240	5.240
59. ***TRANSIT SYSTEM MAINT. AND R	2.770	2.770
60. ***PROFESSIONAL AND ADMIN. SER	195.950	195.950
61. ***UTILITIES MAINT. AND REPAIR	18.600	18.600
62. ***LT. RAIL TRANSIT CONSTRUCTI	1.310	1.310

Source: McDonald & Grefe, Inc.

Table IV-4 illustrates the sectors in which direct and indirect employment was required to support BART's construction and procurements.

The employment effects relate to employment generated within the region by BART's expenditures. The analysis does not consider a related question, did the laborers who filled these jobs come from within the region? Research into the origin of workers would be of interest in documenting BART's impacts, but would have very little transferability.

D. The Impact on Minority Employment Opportunity

The previous section addressed the total regional employment effects from constructing BART. A public policy concern related to overall employment effects, however, is the impact that a major public works construction project like BART has on increasing minority employment opportunity within the work force.[1] The policy objectives of increasing minority employment opportunity include increasing minority employment in specific trades and generally within the total construction work force. It would be ideal if the employment on a public project could be leveraged to have a residual effect on minority opportunity throughout the region. This, however, would entail apprenticeship opportunity and skills improvement, as well as employment. The research plan did not specify an estimate of the employment opportunities generated in the indirect and induced employment resulting from BART capital expenditures. This potential source of increased minority employment could increase the size of any positive impact.

In reviewing the record of minority employment during BART's construction, it must be remembered that BART's construction activity, even in its heaviest year, represented no more than 6 percent of the total construction employment in the Bay Area.[2] On the other hand, it created a working relationship between minority employees and contractors and minority employees and unions, which could have residual effects for minority employment opportunities in the future.[3]

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[1] In this research, minorities were defined as Black, Spanish-American, Orientals, American Indians, Japanese, Chinese, Filipinos, Hawaiians, Koreans and other nonwhites, the EEOC definition.

[2] Discussion of BART construction employment totals compared to Bay Area totals will be found in the next section.

[3] Discrepancies in data on the total number of construction workers will occur, based on the sources cited. The distinction should be maintained, however, between direct employment required to support BART's construction expenditures, which will include many more sectors than construction alone, and on-site construction employment.

Table IV-4

REGIONAL EMPLOYMENT EFFECTS
FROM BART'S CONSTRUCTION AND EQUIPMENT, 1964-76
(In Person-Years)

SF BAY I-O SECTOR DESCRIPTIONS	DIRECT	TOTAL
1. AGRICULTURE AND MINING	0.	874.
2. NEW RESIDENTIAL CONSTRUCTION	0.	0.
3. NEW BUILDING CONSTRUCTION	2051.	2051.
4. NEW UTILITIES CONSTRUCTION	413.	413.
5. NEW HIGHWAY CONSTRUCTION	2313.	2313.
6. NEW CONSTRUCTION ALL OTHER	8778.	8778.
7. MAINT. AND REPAIR CONSTRUCTION	88.	638.
8. ORDINANCE	0.	6.
9. FOOD PROCESSING	0.	1363.
10. TEXTILE PRODUCTS	0.	561.
11. LUMBER AND WOOD PRODUCTS	0.	0.
12. FURNITURE PRODUCTS	0.	158.
13. PAPER AND ALLIED PRODUCTS	0.	231.
14. PRINTING AND PUBLISHING	0.	498.
15. CHEMICALS AND PLASTIC PRODUCTS	0.	392.
16. PETROLEUM REFINING	0.	403.
17. RUBBER AND LEATHER PRODUCTS	0.	178.
18. STONE AND CLAY PRODUCTS	197.	1606.
19. PRIMARY IRON AND STEEL	0.	309.
20. PRIMARY NON-FERROUS METALS	235.	337.
21. METAL CONTAINERS	0.	110.
22. FABRICATED METAL PRODUCTS	1236.	2682.
23. MACHINE SHOP PRODUCTS	5.	90.
24. OTHER FABRICATED METAL PRODUCT	71.	522.
25. CONST. AND MATERIALS HANDLING	67.	180.
26. METAL WORKING EQUIPMENT	0.	26.
27. GENERAL INDUSTRIAL MACHINERY	5.	185.
28. OFFICE AND COMPUTING MACHINERY	174.	226.
29. SERVICE INDUSTRY MACHINES	30.	77.
30. ELECT. TRANSMISSION EQUIP.	105.	168.
31. OTHER ELECTRICAL EQUIP.	1.	136.
32. COMMUNICATION EQUIPMENT	76.	270.

Source: McDonald & Grefe, Inc.

Table IV-4 (continued)

REGIONAL EMPLOYMENT EFFECTS
FROM BART'S CONSTRUCTION AND EQUIPMENT, 1964-76
(In Person-Years)

33. ELECTRONIC COMPONENTS AND EQUI	0.	93.
34. MOTOR VEHICLES AND EQUIPMENT	1.	343.
35. AIRCRAFT AND PARTS	0.	1.
36. OTHER TRANSPORTATION EQUIP.	1.	49.
37. SCIENTIFIC INSTRUMENTS	3.	67.
38. MISCELLANEOUS MANUFACTURING	307.	476.
39. TRANSPORTATION AND WHAREHOUSIN	42.	2426.
40. COMMUNICATIONS	0.	727.
41. ELECT. AND GAS UTILITIES	0.	1040.
42. WHOLESALE AND RETAIL TRADE	0.	14055.
43. FINANCE AND INSURANCE	78.	4272.
44. REAL ESTATE AND RENTAL	56.	518.
45. PERSONAL SERVICES	0.	721.
46. BUSINESS SERVICES	220.	4302.
47. AUTOMOBILE REPAIR AND AMUSEMEN	0.	1912.
48. MEDICAL AND NON-PROFIT SERVICE	0.	3880.
49. GOVERMENT ENTERPRISES	0.	201.
50. PUBLIC TRANSIT FACILITIES	0.	52.
51. MINORITY INCOME	0.	0.
52. NON-MINORITY INCOME	0.	0.
53. ***LANDSCAPING SERVICES	88.	88.
54. ***STATION CONSTRUCTION	645.	645.
55. ***SERVICE FACILITIES CONST.	67.	67.
56. ***OFFICE BUILDING CONSTRUCTIC	63.	63.
57. ***RAIL CONSTRUCTION	1573.	1573.
58. ***BARTD OPERATIONS	89.	89.
59. ***TRANSIT SYSTEM MAINT. AND R	90.	90.
60. ***PROFESSIONAL AND ADMIN. SER	10660.	10660.
61. ***UTILITIES MAINT. AND REPAIR	781.	781.
62. ***LT. RAIL TRANSIT CONSTRUCTI	29.	29.
63. TOTAL MAN-YEAR EQUIVALENTS	30645.	75009.

If it were a policy objective for public works projects to provide the opportunity to enhance the job skills of unemployed minority workers, and this was not an explicit objective in BART's construction as it would be in a federally funded project today, one test of a public project's potential effect on long-term minority employment opportunity is the craft and skill level at which minorities are employed. Most of the construction workers employed for BART construction were laborers, a non-apprenticeable craft. (Only an apprenticeable craft will lead to skill enhancement and salary advancement.) Frequently, laborers are hired for day labor, which requires no training. Also laborers are traditionally the lowest-paid. Construction unions do not actually consider it a craft.

If the majority of the minority employment were in day labor, their involvement in the construction work force would reflect a short-term income effect, rather than the potential for long-term employment (except for the opportunity of minority workers to become familiar with a contractor and to understand hiring and contracting practices).

The craft statistics for minority workers generally were taken from construction union membership data, which indicate the number of minorities who were members of specific building trades unions. All BART construction workers were, by requirement, building trade union members.

Appendix C includes tables on the proportion of minority workers in the BART construction work force, by craft and skill level, based on partial construction site summaries, 1967 through 1971. Although this survey was neither complete nor scientific (and union officials and contractors who were interviewed expressed informal reactions that the statistics appeared to overstate minority representation), it represents the only available data on the issue of minority representation. Thus it has been used as representative of the racial and ethnic composition of the work force, with the previously stated caveat.

Although 35 percent of the total work force surveyed were minority workers, 68 percent of the minority workers were laborers. Since labor is not an apprenticeable craft, all laborers are classified as either journeymen or foremen.

Although 38 percent of all journeymen were minorities, only 20 percent were minorities if laborers are excluded. Only 20 percent of the foremen were minorities, as well. With the laborer work classification excluded, only 11 percent of the foremen were minorities. These statistics emphasize the transitory nature of minority construction employment in aiding minority

workers in their long-term employment potential. Advancement within a day laborer category does not necessarily provide a worker with greater skills for future employment.

Table IV-5 summarizes the minority representation of the total construction workers during the construction period, including and excluding laborers. By contrast with the BART statistics, the San Francisco city contracts bearing affirmative action clauses resulted in minorities representing 22 percent of construction workers, excluding laborers, in 1970.[1] Table IV-6 reflects the ethnic profile of BART construction workers and the racial and ethnic profile of union referrals in the SMSA, and indicates, nonetheless, the effectiveness of BART in increasing minority participation over the unions' ethnic profile. All BART construction was union construction, hence BART was able to increase the minority employment participation in its work force over the minority participation in the eligible work force (as opposed to total work force).

Table IV-5

MINORITY REPRESENTATION
BART CONSTRUCTION

Race/Ethnic Group	BART Construction Workers	BART Construction Workers-Excluding Laborers
Black	22%	10%
Spanish-American	11%	6%
Other (Includes Oriental and American Indian)	2%	2%
TOTAL MINORITY	35%	18%

Source: BART On-Site Construction Work Force Ethnic Data Counts, 1967-1971; Equal Employment Opportunity Commission, City and County of San Francisco, Annual Report (EEO-4), June 30, 1970.

The comparison between minority representation in BART's construction work force and in the regional work force has been made on the basis of BART statistics versus the composition of

[1] City and County of San Francisco, "Equal Employment Opportunity Commission Annual Report EEO-4", June 30, 1971.

Table IV-6

MINORITY REPRESENTATION OF BART CONSTRUCTION WORKERS[1] AND SAN FRANCISCO/OAKLAND UNION MEMBERSHIP

Trade	BART (1967-1971)	Referral Unions S.F./Oakland SMSA
Summary		
All Members of Workers	100%	100%
Total Minority	35%	13%
Electricians		
All Members or Workers	100%	100%
Total Minority	9%	11%
Plumbers		
All Members or Workers	100%	100%
Total Minority	8%	7%
Carpenters		
All Members or Workers	100%	100%
Total Minority	17%	18%
Laborers		
All Members or Workers	100%	100%
Total Minority	61%	31%

[1]BART On-Site Construction Work Force Ethnic Data Counts, 1967-1971. (Numbers represent the mean for 1967 through 1971.)

Source: Equal Employment Opportunity Commission, Local Union Report EEO-3, 1969. (An annual survey of referral unions with 100 or more members.)

the work force in the SMSA, not the nine-county region. This was a conscious research decision since the research objective was not to address the outreach potential of BART's contractors' hiring programs, but rather the impacts public expenditures can have on minority employment opportunity. The majority of the hiring was done within the San Francisco-Oakland SMSA, as was the work. Therefore, the research strategy suggests the comparison of BART's minority representation on the work force which built BART with the proximate work labor force, i.e., the labor force in the immediate hiring area to have included the labor forces of the outer counties in this comparison would have raised the issue of accessibility to employment by race, as well as employability.

While BART was not particularly successful in increasing the work force participation for electricians, plumbers or carpenters, the percentage of minority laborers (which averaged 61 percent over the term of BART's construction) was almost double the minority representation in the union work force classified laborer. These statistics should also indicate that minorities were not given any preferential treatment in the nonlaborer trades (indicative of reverse discrimination), but were referred by the unions at the same rate as any other union members. Interviews with representatives of the construction contractors, trade union council, the Contract Compliance Agency and BART resulted in a general concurrence that BART's primary impact was in introducing the concept of affirmative action or equal employment opportunity to many of the construction trades within the region.

E. The Impact on Construction Wage Rates

It has been suggested that a public project as large as the construction of a regional rapid transit system could have inflationary effects on a regional economy, which may work counter to anti-inflation policies or increase the cost of other public construction. This inflationary pressure would be apparent in construction wage rates.

This research indicates that BART construction expenditures alone had little apparent effect on wage rates in the building trades in the Bay Area. Although Bay Area construction wages rose 40 percent during the years in which major BART construction was occurring, this increase was consistent with longer-term trends, and does not appear attributable to BART construction expenditures in particular. This conclusion is based upon statistical analysis of the components of wage rate increases -- the usual inertia of wage increases, the inflationary element of increases which respond to general inflation, and the supply and demand considerations specific to the Bay Area -- and upon a consideration of explanatory factors in the Bay Area construction labor market.

1. Statistical Analysis

A number of regression models were tested. The model used, which was described earlier, indicates the influence of BART on construction wage rate changes in the San Francisco-Oakland area was minimal, at most (see Table IV-7). The method assumes that there were no substitution employment effects in heavy construction if BART had not been built. In other words, there would not have been competition for the BART labor force. Also, the regression model isolates employment in heavy construction as an independent variable. Obviously, many of the workers who would not have worked on BART might have found jobs in sectors other than heavy construction. In addition, the regression model has only a moderate r^2 (0.4284); it should not be ascribed predictive power. For these reasons, the estimated change in wage rates in Table IV-7 should be treated as upper bounds to any effect that might have occurred as a result of BART.

2. Labor Market Consideration

This statistical approach to the question of impacts subsumes the underlying factors that cause changes in wages in the building trades. In order to make sure that the statistical findings were consistent with what is known of the causal factors, several aspects of the construction labor market were investigated. It was hypothesized that BART construction would affect construction wages only if it played a major role in an overall increase in construction jobs, at a time of fairly full employment in the industry. By causing an increase in demand for labor in a market where labor was in limited supply, the price of labor would be expected to rise.

Research revealed that during BART's chief construction period, overall construction employment did not substantially rise, nor did BART construction employment account for more than six percent of total regional construction employment at any one time. The peak of BART construction employment, in fact, appeared to coincide with a period of relatively lower employment levels in the construction industry as a whole.

Subsequent interviews with construction union officials supported this line of reasoning.

At the outset of the analysis of market factors, construction employment in the San Francisco-Oakland SMSA and in the nine Bay Area counties was tabulated for 1960-1975. As shown in

Table IV-7

CHANGES IN WAGE RATE INCREASES
UNDER THE NO-BART ALTERNATIVE

Year	BART SIC 16 Employment (Thousands)	State of California SIC 16 Employment (Thousands)	State of California SIC 16 Employment Less BART Employment (Thousands)	% Change in State of California SIC 16 Employment Lagged 1 Year	Hypothetical No-BART % Change in SIC 16 Employment Lagged 1 Year	Net Effect on Change in Employment (BART)-(No-BART)	Net % BART Effect on Change in Wage Rate in Oakland/ San Francisco Area in SIC 16
1966	(1.25)	(72.3)	71.0				
1967	2.51	68.8	66.3				
1968	2.96	70.1	67.1	-6.6%	-4.8%	1.8%	0.32%
1969	2.20	73.7	71.5	1.2	1.9	0.7	0.12
1970	1.77	73.4	71.6	6.6	5.1	1.5	-0.26
1971	1.71	67.3	65.6	0.1	-0.4	0.5	-0.09
1972				-8.4	-8.3	0.1	0.02

Source: McDonald & Grefe, Inc.

Table IV-8 construction employment during BART's chief construction period was not significantly higher than the level in the preceding and subsequent periods.[1]

The level of BART construction employment was then compared with total Bay Area construction employment for each of BART's chief construction years, as shown in Table IV-9. This table clearly indicates that BART's impact on the construction market was relatively small and short-lived. At its 1968 peak, BART accounted for nearly 6 percent of total Bay Area Construction employment. Even this figure exaggerates BART's impact on the local labor market, as the market for much of the specialized work involved in rapid transit construction could extend far beyond the nine Bay Area counties.

Specific data on regional unemployment in the construction industry are not published on an annual basis for the years 1960-1973. The figures on total employment in the industry shown in Table IV-9 give some indication of unemployment levels in the industry, however, As the overall level of employment in construction rose only slightly from 1960 to 1975 in the Bay Area, the number of potential construction workers in the area presumably remained relatively constant during that period (although some would say it declined as Vietnam construction activity drew upon the Bay Area labor force). The difference between the average level of employment over the period and the level of any specific year yields an approximate index of the degree of unemployment in each year.

Given these assumptions, it appears that the level of construction employment during BART's chief construction years was about average for the long-term trend, but that the unemployment level may have increased in BART's peak years, 1967-1968.

Interviews with construction union officials of both the Teamsters and AFL-CIO organizations supported the conclusions suggested by the labor market analysis.[2] One union official noted that

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[1]This indication that BART construction occurred during a relatively slow period in the Bay Area construction industry is supported by the results of a shift/share analysis of the regional economy undertaken for this project. The shift/share analysis indicated that the Bay Area construction industry experienced a relative competitive disadvantage over the level of activity which might have been expected in the Bay Area during the period 1965-1973, given its industrial mix and the national trend.

[2]Teamster's Local 216 (Building Materials and Construction) and Building and Construction Trade, AFL-CIO.

Table IV-8

CONSTRUCTION EMPLOYMENT IN THE BAY AREA

Year	San Francisco/Oakland (Thousands)	All Nine Counties (Thousands)
1960	58.9	78.2
1961	57.3	77.7
1962	60.5	81.6
1963	66.4	90.8
1964	67.1	91.5
1965	68.1	91.0
1966	65.1	86.4
1967	60.1	80.1
1968	62.6	84.7
1969	64.6	88.5
1970	61.9	84.1
1971	60.2	84.3
1972	60.9	86.4
1973	63.9	91.0
1974	64.3	90.5
1975	59.3	83.8

Source: California Employment Development Department, "Wage and Salary Workers in Nonagricultural Establishments, San Francisco-Oakland Metropolitan Area 1976-77," "Area Manpower Review" (San Jose, Santa Rosa and Vallejo-Fairfield-Napa SMSAs, 1976-1977), "Estimated Number of Wage and Salary Workers in Nonagricultural Establishments, by Industry" (Nine Bay Area Counties, 1949-1966).

Table IV-9

COMPARISON OF BART AND BAY AREA CONSTRUCTION EMPLOYMENT

Year	BART On-Site Construction Employment (Thousands)	Total Bay Area Construction Employment (Thousands)	BART As Percent of Total
1967	4.250	80.1	5.31
1968	5.000	84.7	5.90
1969	3.075	88.5	3.47
1970	2.400	84.1	2.85
1971	1.670	84.3	1.98

Source: PBTB Monthly Progress Reports.

construction union contracts are generally of three years' duration, and thus, their terms are not usually influenced by relatively short-term projects, such as the individual construction contracts for each of BART's segments. The other union representative agreed that BART construction, in this case, had no significant impact on Bay Area construction wage rates. He argued, however, that had employment in the industry been fuller, a project of BART's scale might have boosted wage rates significantly.

A consideration of labor supply and demand factors that might affect construction wages thus appears to bear out the conclusions reached through statistical analysis. BART construction was a short-term, relatively minor source of employment in terms of the regional labor market. It coincided with no increases in overall construction employment and, in fact, appeared to peak at a time of relatively low employment in the construction industry.

The increases in construction wage rates that occurred over BART's chief construction period corresponded, however, to increases in the cost of living and to increases in construction wages nationally, as they did in the years preceding and following BART's construction. These factors, rather than shifts in the market for construction labor, appear to explain the increases in construction wage rates during BART construction.

F. Regional Income Effects

An important aspect of describing a major public works project's benefits to a region, particularly those projects which require substantial local funding, is the effect construction will have on household income. The income effects presented in this section have been estimated with the input-output model. The figures must be viewed in perspective. They represent a gross augmentation of household incomes in the region from direct and indirect expenditures for construction. This analysis was structured to evaluate independently the effects on nonminority and minority households. The total income effects, however, are an aggregate for the region. Without any information on the distribution of this income over the households of the region, any average income effect is a meaningless statistic.

Household income in the region increased an estimated $927 million due to BART's capital expenditures, less than one-half of one percent of the total estimated personal income in the

region during that period.[1] The distribution of this increase in total household income among minority households was approximately 12.5 percent, which was generally consistent with the minority household share of total income throughout the period. Regardless of the employment impacts of BART's construction, the indirect economic activity triggered by BART's construction requirements failed to maintain the percentage of income distributed to minority households from direct expenditures (21 percent).

[1] No attempt should be made to compare the increase in household income with the cost of BART to compute a benefit-cost ratio for households. There is no correlation between the distribution of income effects among households and the distribution of the tax burden among households, nor is the tax burden identified here.

V. THE DIRECT AND INDIRECT ECONOMIC IMPACTS OF BART OPERATIONS

There are two distinct objects of expenditure associated with implementing a rapid transit system. First, and frequently the more immediately visible, is the capital investment in rights of way, track, facilities and rolling stock. The impacts of those investments in rapid transit frequently occur within the first decade after the decision to build is made. This impact responds to an infusion of capital into the regional economy, but the only residual effects may be those of employment opportunity from workers trained during the construction period, or regional production capabilities developed specifically for transit improvements.

The other major object of expenditure associated with rapid transit is the continuing expenditure for operations. These expenditures must be met from a greater percentage of local dollars than the capital investment under current federal funding policies, and have a longer-term effect on the regional economy. They also represent long-term burdens of a proposed system. Finally, in the long run, these expenditures frequently will mitigate for capital intensive systems, which traditionally have substituted initial capital investment for a system which will meet travel demand volumes with fewer operating personnel, i.e., the notion that rapid rail transit has lower operating costs per passenger than a bus-based system.

In this section, the economic impacts, both direct and indirect, of transit's continuing operating expenditures are evaluated. These impacts include the requirements for regional output of goods and services (the so-called gross regional product); the direct, indirect and induced employment equivalence of this economic activity; the impact on minority employment opportunity from introducing a major new public employer into the region; and the effects of operating expenditures on regional household income, both nonminority and minority.

A. The Cost Of Operating Transit (The Direct Expenditures)

For purposes of evaluating the operating costs for rapid transit, 1976 service levels for BART were assumed to represent full service levels.[1] The costs associated with that full service level, classified by economic sector, were used to test the impacts of operating expenditures.

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[1] Metropolitan Transportation Commission, "The No-BART Alternative Financing Plan," February 1977.

The impact of BART operations on the economy is the difference between the level of BART operating expenditures and the level of expenditures which other transit agencies would have incurred to meet transit requirements in the absence of BART. Thus, it was also necessary to classify the operating costs for the No-BART Alternative (NBA), which is represented by a higher level of service then currently provided by existing transit agencies -- AC Transit, San Francisco Muni and Greyhound.

The costs of the BART scenario were established by classifying all operating costs for each of the entities to the sectors in which these expenditures have occurred over recent years. The classification is itemized, by sector, for each operator in Table V-1.

The costs of operating the NBA, which would have excluded BART, but involved increased expenditures by the other entities, are reflected in Table V-2, classified by economic sector. The net difference (or the BART impact on operating expenditures) is reflected in Table V-3. The contents of this last table represent the costs used to evaluate BART's operating impacts throughout this section.

To test the impacts of operating expenditures, the 1974 input-output model was used. Instead of establishing subsectors related specifically to construction activity, however, the "Other Public Transit Systems" sector (Sector Number 50) was modified to provide separate estimates of BART, AC Transit, San Francisco MUNI and Greyhound Western expenditures. These local and regional transit sectors (numbered 53 through 56) are apparent in Table V-4.

B. Regional Output Effects

BART's impact on annual regional transit operating expenditures is counter to the expectations of rapid transit operating efficiencies. BART's operations require an increase of $46.7 million in direct expenditures beyond what other agencies would spend to meet travel demand, and these expenditures generate a total of $149.0 million, in additional regionally-produced goods and services.[1]

Table V-4 illustrates the economic sectors directly and indirectly affected by this impact.

The multipliers for expenditures on operating costs for rapid transit versus bus transit in the Bay Area are illustrated in

[1] BART's budget alone would have a direct impact of $59.8 million and a total sales and income requirement of $189.6 million.

Table V-1

CLASSIFICATION OF BART SCENARIO OPERATING COSTS
(In Millions of 1976 Dollars)

SF BAY I-O SECTOR DESCRIPTIONS	BARTD	SF MUNI	AC TRANSIT	GREYHOUND
1. AGRICULTURE AND MINING	0.000	0.000	0.000	0.000
2. NEW RESIDENTIAL CONSTRUCTION	0.000	0.000	0.000	0.000
3. NEW BUILDING CONSTRUCTION	0.000	0.000	0.000	0.000
4. NEW UTILITIES CONSTRUCTION	0.000	0.000	0.000	0.000
5. NEW HIGHWAY CONSTRUCTION	0.000	0.000	0.000	0.000
6. NEW CONSTRUCTION ALL OTHER	0.000	0.000	0.000	0.000
7. MAINTENANCE AND REPAIR CONSTRU	1.940	.452	.330	.007
8. ORDINANCE	0.000	0.000	0.000	0.000
9. FOOD PROCESSING	0.000	0.000	0.000	0.000
10. TEXTILE PRODUCTS	0.000	.097	.032	.001
11. LUMBER AND WOOD PRODUCTS	0.000	0.000	0.000	0.000
12. FURNITURE PRODUCTS	0.000	0.000	0.000	0.000
13. PAPER AND ALLIED PRODUCTS	.047	.027	.015	.000
14. PRINTING AND PUBLISHING	.048	.351	.191	.004
15. CHEMICALS AND PLASTIC PRODUCTS	0.000	0.000	0.000	0.000
16. PETROLEUM REFINING	.040	1.566	1.139	.026
17. RUBBER AND LEATHER PRODUCTS	0.000	.330	.208	.005
18. STONE AND CLAY PRODUCTS	0.000	0.000	0.000	0.000
19. PRIMARY IRON AND STEEL	.005	.045	0.000	0.000
20. PRIMARY NON-FERROUS METALS	0.000	0.000	0.000	0.000
21. METAL CONTAINERS	0.000	0.000	0.000	0.000
22. FABRICATED STUCTURAL METAL PRO	.043	.024	.005	0.000
23. MACHINE SHOP PRODUCTS	.022	.078	.060	0.000
24. OTHER FABRICATED METAL PRODUCT	.026	.034	.016	.000
25. CONST. AND MATERIALS HANDLING	0.000	0.000	0.000	0.000
26. METAL WORKING EQUIPMENT	0.000	.046	.020	.000
27. GENERAL INDUSTRIAL MACHINERY	0.000	0.000	0.000	0.000
28. OFFICE AND COMPUTING MACHINERY	.038	.008	.004	.000
29. SERVICE INDUSTRY MACHINES	0.000	0.000	0.000	0.000
30. ELECTRIAL TRANSMISSION EQUIPME	.108	.015	0.000	0.000
31. OTHER ELECTRICLA EQUIP. NEC	.030	.022	0.000	0.000
32. COMMUNICATION EQUIPMENT	0.000	0.000	0.000	0.000
33. ELECTRONIC COMPONENTS AND EQUI	.087	0.000	0.000	0.000
34. MOTOR VEHICLES AND EQUIPMENT	0.000	.015	.007	.000
35. AIRCRAFT AND PARTS	0.000	0.000	0.000	0.000
36. OTHER TRANSPORTATION EQUIP.	0.000	0.000	0.000	0.000
37. SCEINTIFIC INSTRUMENTS	0.000	0.000	0.000	0.000
38. MISCELLANEOUS MANUFACTURING	0.000	.032	.012	.000
39. TRANSPORTATION AND WHAREHOUSIN	.002	.029	.025	.001
40. COMMUNICATIONS	.312	.039	.018	.000
41. ELECT. AND GAS UTILITIES	2.743	.711	.046	.001
42. WHOLESALE AND RETAIL TRADE	.144	.240	.923	.021
43. FINANCE AND INSURANCE	1.128	1.973	1.695	.039
44. REAL ESTATE AND RENTAL	.151	.040	.031	.001
45. PERSONAL SERVICES	.006	0.000	0.000	0.000
46. BUSSINESS SERVICES	1.700	.672	.469	.011
47. AUTOMOBILE REPAIR AND AMUSEMEN	.017	.014	.011	.000
48. MEDIAL SERVICES AND NON-PROFIT	.522	.339	.315	.007
49. GOVERNMENT ENTERPRISES	.042	0.000	.022	.000
50. PUBLIC TRANSIT FACILITIES	2.157	0.000	0.000	0.000
51. MINORITY INCOME	8.514	26.113	9.883	.166
52. NON-MINORITY INCOME	32.020	31.914	16.126	.426
53. INTERMEDIATE OUTLAYS	11.357	7.798	5.591	.127
54. UNALLOCATED VALUE ADDED	5.438	4.426	7.547	.172
55. REGIONAL IMPORTS	2.467	1.921	1.302	.034
56. TOTAL	59.806	72.174	40.449	.920

Table V-2

CLASSIFICATION OF NBA OPERATING COSTS
(In Millions of 1976 Dollars)

SF BAY I-O SECTOR DESCRIPTIONS	BARTO	SF MUNI	AC TRANSIT	GREYHOUND
1. AGRICULTURE AND MINING	0.000	0.000	0.000	0.000
2. NEW RESIDENTIAL CONSTRUCTION	0.000	0.000	0.000	0.000
3. NEW BUILDING CONSTRUCTION	0.000	0.000	0.000	0.000
4. NEW UTILITIES CONSTRUCTION	0.000	0.000	0.000	0.000
5. NEW HIGHWAY CONSTRUCTION	0.000	0.000	0.000	0.000
6. NEW CONSTRUCTION ALL OTHER	0.000	0.000	0.000	0.000
7. MAINTENANCE AND REPAIR CONSTRU	0.000	.501	.341	.039
8. ORDINANCE	0.000	0.000	0.000	0.000
9. FOOD PROCESSING	0.000	0.000	0.000	0.000
10. TEXTILE PRODUCTS	0.000	.107	.033	.004
11. LUMBER AND WOOD PRODUCTS	0.000	0.000	0.000	0.000
12. FURNITURE PRODUCTS	0.000	0.000	0.000	0.000
13. PAPER AND ALLIED PRODUCTS	0.000	.030	.016	.002
14. PRINTING AND PUBLISHING	0.000	.389	.197	.023
15. CHEMICALS AND PLASTIC PRODUCTS	0.000	0.000	0.000	0.000
16. PETROLEUM REFINING	0.000	1.512	1.180	.135
17. RUBBER AND LEATHER PRODUCTS	0.000	.366	.216	.025
18. STONE AND CLAY PRODUCTS	0.000	0.000	0.000	0.000
19. PRIMARY IRON AND STEEL	0.000	.050	0.000	0.000
20. PRIMARY NON-FERROUS METALS	0.000	0.000	0.000	0.000
21. METAL CONTAINERS	0.000	0.000	0.000	0.000
22. FABRICATED STUCTURAL METAL PRO	0.000	.026	.016	0.000
23. MACHINE SHOP PRODUCTS	0.000	.087	.062	0.000
24. OTHER FABRICATED METAL PRODUCT	0.000	.038	.017	.002
25. CONST. AND MATERIALS HANDLING	0.000	0.000	0.000	0.000
26. METAL WORKING EQUIPMENT	0.000	.051	.020	.002
27. GENERAL INDUSTRIAL MACHINERY	0.000	0.000	0.000	0.000
28. OFFICE AND COMPUTING MACHINERY	0.000	.009	.005	.001
29. SERVICE INDUSTRY MACHINES	0.000	0.000	0.000	0.000
30. ELECTRICAL TRANSMISSION EQUIPME	0.000	.017	0.000	0.000
31. OTHER ELECTRICLA EQUIP. NEC	0.000	.024	0.000	0.000
32. COMMUNICATION EQUIPMENT	0.000	0.000	0.000	0.000
33. ELECTRONIC COMPONENTS AND EQUI	0.000	0.000	0.000	0.000
34. MOTOR VEHICLES AND EQUIPMENT	0.000	.017	.007	.001
35. AIRCRAFT AND PARTS	0.000	0.000	0.000	0.000
36. OTHER TRANSPORTATION EQUIP.	0.000	0.000	0.000	0.000
37. SCEINTIFIC INSTRUMENTS	0.000	0.000	0.000	0.000
38. MISCELANEOUS MANUFACTURING	0.000	.035	.012	.001
39. TRANSPORTATION AND WHAREHOUSIN	0.000	.032	.026	.003
40. COMMUNICATIONS	0.000	.043	.018	.002
41. ELECT. AND GAS UTILITIES	0.000	.788	.048	.005
42. WHOLESALE AND RETAIL TRADE	0.000	.265	.956	.110
43. FINANCE AND INSURANCE	0.000	2.185	1.756	.261
44. REAL ESTATE AND RENTAL	0.000	.045	.032	.004
45. PERSONAL SERVICES	0.000	0.000	0.000	0.000
46. BUSSINESS SERVICES	0.000	.744	.485	.056
47. AUTOMOBILE REPAIR AND AMUSEMEN	0.000	.016	.011	.001
48. MEDIAL SERVICES AND NON-PROFIT	0.000	.375	.327	.037
49. GOVERMENT ENTERPRISES	0.000	0.000	.023	.003
50. PUBLIC TRANSIT FACILITIES	0.000	0.000	0.000	0.000
51. MINORITY INCOME	0.000	28.908	16.237	.884
52. NON-MINORITY INCOME	0.000	35.333	16.704	2.222
53. INTERMEDIATE OUTLAYS	0.000	8.633	5.792	.664
54. UNALLOCATED VALUE ADDED	0.000	4.900	7.818	.895
55. REGIONAL IMPORTS	0.000	2.126	1.349	.175
56. TOTAL	0.000	79.900	41.900	4.800

Table V-3

BART IMPACT IN OPERATING EXPENDITURES BY SECTOR
(In Millions of 1976 Dollars)

SF BAY I-O SECTOR DESCRIPTIONS	BART	SF MUNI	AC TRANSIT	GREYHOUND
1. AGRICULTURE AND MINING	0.000	0.000	0.000	0.000
2. NEW RESIDENTIAL CONSTRUCTION	0.000	0.000	0.000	0.000
3. NEW BUILDING CONSTRUCTION	0.000	0.000	0.000	0.000
4. NEW UTILITIES CONSTRUCTION	0.000	0.000	0.000	0.000
5. NEW HIGHWAY CONSTRUCTION	0.000	0.000	0.000	0.000
6. NEW CONSTRUCTION ALL OTHER	0.000	0.000	0.000	0.000
7. MAINTENANCE AND REPAIR CONSTRU	-1.540	.049	.012	.032
8. ORDINANCE	0.000	0.000	0.000	0.000
9. FOOD PROCESSING	0.000	0.000	0.000	0.000
10. TEXTILE PRODUCTS	0.000	.010	.001	.003
11. LUMBER AND WOOD PRODUCTS	0.000	0.000	0.000	0.000
12. FURNITURE PRODUCTS	0.000	0.000	0.000	0.000
13. PAPER AND ALLIED PRODUCTS	-.047	.003	.001	.001
14. PRINTING AND PUBLISHING	-.048	.038	.007	.018
15. CHEMICALS AND PLASTIC PRODUCTS	0.000	0.000	0.000	0.000
16. PETROLEUM REFINING	-.040	.147	.041	.109
17. RUBBER AND LEATHER PRODUCTS	0.000	.036	.007	.020
18. STONE AND CLAY PRODUCTS	0.000	0.000	0.000	0.000
19. PRIMARY IRON AND STEEL	-.005	.005	0.000	0.000
20. PRIMARY NON-FERROUS METALS	0.000	0.000	0.000	0.000
21. METAL CONTAINERS	0.000	0.000	0.000	0.000
22. FABRICATED STUCTURAL METAL PRO	-.043	.003	.000	0.000
23. MACHINE SHOP PRODUCTS	-.022	.008	.002	0.000
24. OTHER FABRICATED METAL PRODUCT	-.026	.004	.001	.002
25. CONST. AND MATERIALS HANDLING	0.000	0.000	0.000	0.000
26. METAL WORKING EQUIPMENT	0.000	.005	.001	.002
27. GENERAL INDUSTRIAL MACHINERY	0.000	0.000	0.000	0.000
28. OFFICE AND COMPUTING MACHINERY	-.038	.001	.000	.000
29. SERVICE INDUSTRY MACHINES	0.000	0.000	0.000	0.000
30. ELECTRIAL TRANSMISSION EQUIPME	-.108	.002	0.000	0.000
31. OTHER ELECTRICLA EQUIP. NEC	-.030	.002	0.000	0.000
32. COMMUNICATION EQUIPMENT	0.000	0.000	0.000	0.000
33. ELECTRONIC COMPONENTS AND EQUI	-.087	0.000	0.000	0.000
34. MOTOR VEHICLES AND EQUIPMENT	0.000	.002	.000	.001
35. AIRCRAFT AND PARTS	0.000	0.000	0.000	0.000
36. OTHER TRANSPORTATION EQUIP.	0.000	0.000	0.000	0.000
37. SCEINTIFIC INSTRUMENTS	0.000	0.000	0.000	0.000
38. MISCELANEOUS MANUFACTURING	0.000	.003	.000	.001
39. TRANSPORTATION AND WHAREHOUSIN	-.002	.003	.001	.002
40. COMMUNICATIONS	-.312	.004	.001	.002
41. ELECT. AND GAS UTILITIES	-2.743	.077	.032	.004
42. WHOLESALE AND RETAIL TRADE	-.144	.026	.033	.089
43. FINANCE AND INSURANCE	-1.128	.213	.061	.163
44. REAL ESTATE AND RENTAL	-.151	.004	.001	.003
45. PERSONAL SERVICES	-.006	0.000	0.000	0.000
46. BUSSINESS SERVICES	-1.700	.072	.017	.045
47. AUTOMOBILE REPAIR AND AMUSEMEN	-.017	.002	.000	.001
48. MEDICAL SERVICES AND NON-PROFIT	-.522	.036	.011	.030
49. GOVERMENT ENTERPRISES	-.042	0.000	.001	.002
50. PUBLIC TRANSIT FACILITIES	-2.157	0.000	0.000	0.000
51. MINORITY INCOME	-6.514	2.812	.355	.699
52. NON-MINORITY INCOME	-32.030	3.437	.578	1.796
53. INTERMEDIATE OUTLAYS	-11.357	.840	.201	.536
54. UNALLOCATED VALUE ADDED	-5.438	.477	.271	.724
55. REGIONAL IMPORTS	-2.467	.207	.047	.142
56. TOTAL	-59.806	7.773	1.451	3.880

Table V-4

REGIONAL OUTPUT EFFECTS
FROM BART OPERATING EXPENDITURES 1976
(In Millions of 1976 Dollars)

SF BAY I-O SECTOR DESCRIPTIONS	TOTAL
1. AGRICULTURE AND MINING	.967
2. NEW RESIDENTIAL CONSTRUCTION	0.000
3. NEW BUILDING CONSTRUCTION	0.000
4. NEW UTILITIES CONSTRUCTION	0.000
5. NEW HIGHWAY CONSTRUCTION	0.000
6. NEW CONSTRUCTION ALL OTHER	0.000
7. MAINT. AND REPAIR CONSTRUCTION	2.453
8. ORDINANCE	.013
9. FOOD PROCESSING	4.486
10. TEXTILE PRODUCTS	.628
11. LUMBER AND WOOD PRODUCTS	0.000
12. FURNITURE PRODUCTS	.192
13. PAPER AND ALLIED PRODUCTS	.459
14. PRINTING AND PUBLISHING	.854
15. CHEMICALS AND PLASTIC PRODUCTS	.879
16. PETROLEUM REFINING	.939
17. RUBBER AND LEATHER PRODUCTS	.154
18. STONE AND CLAY PRODUCTS	.160
19. PRIMARY IRON AND STEEL	.074
20. PRIMARY NON-FERROUS METALS	.014
21. METAL CONTAINERS	.287
22. FABRICATED METAL PRODUCTS	.094
23. MACHINE SHOP PRODUCTS	.066
24. OTHER FABRICATED METAL PRODUCT	.103
25. CONST. AND MATERIALS HANDLING	.006
26. METAL WORKING EQUIPMENT	.004
27. GENERAL INDUSTRIAL MACHINERY	.028
28. OFFICE AND COMPUTING MACHINERY	.070
29. SERVICE INDUSTRY MACHINES	.026
30. ELECT. TRANSMISSION EQUIP.	.138
31. OTHER ELECTRICAL EQUIP.	.109
32. COMMUNICATION EQUIPMENT	.014
33. ELECTRONIC COMPONENTS AND EQUI	.145
34. MOTOR VEHICLES AND EQUIPMENT	1.858
35. AIRCRAFT AND PARTS	.006
36. OTHER TRANSPORTATION EQUIP.	.039
37. SCIENTIFIC INSTRUMENTS	.102
38. MISCELLANEOUS MANUFACTURING	.108
39. TRANSPORTATION AND WHAREHOUSIN	1.569
40. COMMUNICATIONS	.977
41. ELECT. AND GAS UTILITIES	4.663
42. WHOLESALE AND RETAIL TRADE	7.882
43. FINANCE AND INSURANCE	4.424
44. REAL ESTATE AND RENTAL	4.149
45. PERSONAL SERVICES	1.431
46. BUSINESS SERVICES	3.076
47. AUTOMOBILE REPAIR AND AMUSEMEN	1.873
48. MEDICAL AND NON-PROFIT SERVICE	3.722
49. GOVERMENT ENTERPRISES	1.142
50. * OTHER PUBLIC TRANSIT	.015
51. MINORITY INCOME	11.198
52. NON-MINORITY INCOME	49.663
53. * BART OPERATIONS	59.836
54. * AC TRANSIT OPERATIONS	-1.451
55. * SAN FRANCISCO MUNI	-7.726
56. * GREYHOUND (LOCAL ONLY)	-3.880
57. TOTAL	148.978

Table V-5. These multipliers indicate the total economic activity generated in the regional economy for each dollar spent by each transit agency for operations. Thus, for each operating dollar spent on BART, the gross regional product -- all the direct, indirect and induced sales of goods or services -- increases by $3.19. Although the multipliers are very similar for each dollar spent, since BART's operating expenditures are so much larger than those estimated for the No-BART Alternative, the volume of regional economic activity --regional sales and income -- generated by BART's operating budget is correspondingly greater.

Table V-5

SALES AND INCOME MULTIPLIERS
FOR OPERATING EXPENDITURES

BARTD Operations	3.187
AC Transit Operations	3.223
San Francisco MUNI	3.181
Greyhound Western (Local Only)	3.034

Source: McDonald & Grefe, Inc.

The multipliers vary based on the type of expenditures made in a transit agency's budget. Goods and services purchased within the region, for instance, will cause the regional multiplier to increase over the same expenditures for a service contract with a Southern California firm.

Appendix D contains a digression on regional multiplier analysis which places these multipliers in the proper context vis-a-vis econometric or other input-output multipliers.

The full effect of the operating costs will change and, perhaps, increase over time. In subsequent years, the impacts will change, but estimating the effect involves assumptions concerning each economic sector's rate of inflation and any technological changes in interindustry relationships.

C. Regional Employment Effects

BART's direct employment for full service operations is assumed to be 1,865 for purposes of this analysis. The BART impact on direct employment represents the difference between BART's employment and the requirements of the NBA to maintain service levels. On the basis of current experience, the NBA operators would require 600 additional employees for the level of service implied by increased operating expenditures. Thus, the BART

Table V-6

BART IMPACT ON EMPLOYMENT
FROM ANNUAL OPERATING EXPENDITURES
(Jobs or Person-Year Equivalents)

SF BAY I-O SECTOR DESCRIPTIONS	INDIRECT
1. AGRICULTURE AND MINING	47.
2. NEW RESIDENTIAL CONSTRUCTION	0.
3. NEW BUILDING CONSTRUCTION	0.
4. NEW UTILITIES CONSTRUCTION	0.
5. NEW HIGHWAY CONSTRUCTION	0.
6. NEW CONSTRUCTION ALL OTHER	0.
7. MAINT. AND REPAIR CONSTRUCTION	80.
8. ORDINANCE	0.
9. FOOD PROCESSING	73.
10. TEXTILE PRODUCTS	33.
11. LUMBER AND WOOD PRODUCTS	0.
12. FURNITURE PRODUCTS	5.
13. PAPER AND ALLIED PRODUCTS	10.
14. PRINTING AND PUBLISHING	25.
15. CHEMICALS AND PLASTIC PRODUCTS	13.
16. PETROLEUM REFINING	8.
17. RUBBER AND LEATHER PRODUCTS	3.
18. STONE AND CLAY PRODUCTS	3.
19. PRIMARY IRON AND STEEL	2.
20. PRIMARY NON-FERROUS METALS	0.
21. METAL CONTAINERS	8.
22. FABRICATED METAL PRODUCTS	4.
23. MACHINE SHOP PRODUCTS	3.
24. OTHER FABRICATED METAL PRODUCT	5.
25. CONST. AND MATERIALS HANDLING	0.
26. METAL WORKING EQUIPMENT	0.
27. GENERAL INDUSTRIAL MACHINERY	2.
28. OFFICE AND COMPUTING MACHINERY	1.
29. SERVICE INDUSTRY MACHINES	1.
30. ELECT. TRANSMISSION EQUIP.	3.
31. OTHER ELECTRICAL EQUIP.	3.
32. COMMUNICATION EQUIPMENT	0.
33. ELECTRONIC COMPONENTS AND EQUI	6.
34. MOTOR VEHICLES AND EQUIPMENT	13.
35. AIRCRAFT AND PARTS	0.
36. OTHER TRANSPORTATION EQUIP.	1.
37. SCIENTIFIC INSTRUMENTS	1.
38. MISCELLANEOUS MANUFACTURING	5.
39. TRANSPORTATION AND WHAREHOUSIN	44.
40. COMMUNICATIONS	25.
41. ELECT. AND GAS UTILITIES	120.
42. WHOLESALE AND RETAIL TRADE	531.
43. FINANCE AND INSURANCE	201.
44. REAL ESTATE AND RENTAL	14.
45. PERSONAL SERVICES	72.
46. BUSINESS SERVICES	121.
47. AUTOMOBILE REPAIR AND AMUSEMEN	59.
48. MEDICAL AND NON-PROFIT SERVICE	190.
49. GOVERNMENT ENTERPRISES	19.
50. * OTHER PUBLIC TRANSIT	1.
51. MINORITY INCOME	0.
52. NON-MINORITY INCOME	0.
53. * BARTO OPERATIONS	1865.
54. * AC TRANSIT OPERATIONS	-67.
55. * SAN FRANCISCO MUNI	-373.
56. * GREYHOUND (LOCAL ONLY)	-160.
57. TOTAL	3017.

Source: McDonald & Grefe, Inc.

impact on direct employment is 1,265 employees. The regional employment effects of BART have been measured on this basis.[1]

BART's regional employment impact from direct expenditures and the associated indirect and induced totals over 3,000 permanent jobs. Table V-6 indicates the direct and total employment requirements of BART's budget, beyond what the NBA would require.

An an intermediate research finding, Table V-7 summarizes the employment coefficients of BART and the region's other transit systems. These coefficients reflect the total employment impact of all the interindustry relationships upon which the input-output model is formulated.

Table V-7

EMPLOYMENT CHARACTERISTICS OF TRANSIT AGENCIES (1976)

Transit Agency	Mode	Employment per Million Dollars of Operating Expenditure
BART	Heavy Rail	31.18
AC Transit	Bus	45.86
San Francisco MUNI	Bus/Light Rail/Cable Car	48.31

Source: McDonald & Grefe, Inc.

D. Regional Income Effects

The impacts of BART's operations on household income in the region are a direct reflection of the high level of operating costs for BART. Total personal income in the region increases an estimated $51.9 million annually, due to BART's operating expenditures. Almost 22 percent of this income went to minority households, considerably higher than the distribution of personal income generated by capital expenditures.

[1]The 600 employee increment to the labor forces of AC Transit, MUNI and Greyhound may be generous, despite their relationship to current operating requirements. If the NBA requirements are high, BART's impact is underestimated.

E. The Impact of BART Permanent Employment on Employment Opportunity

The effectiveness of BART's permanent employment practices in improving employment opportunity for minorities in transit within the region can be observed from the minority participation in the BART work force compared to other transit agencies which would serve the region in the absence of BART. A consistent research approach to this issue would require comparing a profile of the work force of all transit agencies in the nine counties with BART and all transit agencies in the region without BART, adding 600 employees to the NBA profile, according to a hypothetical racial and sex distribution. Consistency in the technique of comparing BART with the NBA, in this case, appeared to mask the relevant findings rather than contribute to them. As a result, in this area of analysis, BART's employment profile, as a new rapid transit agency, was compared with the employment profile of the two dominant bus agencies in the region, AC Transit and MUNI, as examples of the employment patterns which might be experienced with a bus oriented NBA.

The size of BART's permanent work force in 1976 was 1,865. The classification of the BART work force by race or ethnicity and salary in 1976 is contained in Table V-8. The classification by sex is contained in Table V-9. The sources of these data, as well as those in subsequent tables in this section, are the Equal Employment Opportunity Commission reports. The EEOC requirement also classifies employment into eight job categories: officials/administrators, professionals, technicians, protective service, paraprofessionals, office and clerical, skilled craft and service maintenance. Employees in each job category are further classified by race or ethnicity and sex in Tables V-10 and V-11. The rubric "minority" includes Black, Spanish-American, American Indian, Oriental and other nonwhite.

1. Employment by Sex

Transit employment in the region with BART is 11.4 percent female. Within BART's work force, however, the percentage of female employees rises to 18.8. Without BART, the total regional transit work force would employ only 8.8 percent females. Overall, BART's impact on female employment opportunity has been relatively strong, compared to other transit agencies. The fact that BART began operations when equal employment opportunity for women was a national issue and was able to establish equal employment standards for its entire work force as a new agency imbued with a modern concept of technology, management, marketing and research may account for this performance.

Table V-8

IMPACT OF BART ON MINORITY EMPLOYMENT BY PUBLIC TRANSIT IN THE BAY AREA BY SALARY LEVEL

	BART				AC Transit and MUNI			
	White		Minority		White		Minority	
Salary Levels	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total
$ 0- 7,999	0	0	0	0	10	0.2	6	0.2
8,000-12,999	43	3.8	57	7.6	460	16.8	387	14.7
13,000-15,999	195	17.5	195	26.0	1,096	40.1	988	37.6
16,000-24,999	796	71.4	485	64.7	1,028	37.6	1,189	45.2
$25,000+	81	7.3	13	1.7	144	5.3	61	2.3
TOTAL	1,115	100%	750	100%	2,738	100%	2,631	100%

Source: Equal Employment Opportunity Commission, Local Government Information System, 1976.

Table V-9

IMPACT OF BART ON FEMALE EMPLOYMENT IN PUBLIC TRANSIT
IN THE BAY AREA BY SALARY LEVEL

	BART				AC Transit and MUNI			
	Male		Female		Male		Female	
Salary Levels	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total
$ 0- 7,999	0	0.0	0	0.0	11	0.2	5	1.0
8,000-12,999	35	2.3	65	18.5	504	10.4	343	72.3
13,000-15,999	246	16.2	144	41.0	1,980	40.4	104	22.0
16,000-24,999	1,141	75.4	140	39.9	2,196	44.9	21	4.4
$25,000+	92	6.1	2	0.6	204	4.1	1	0.3
TOTAL	1,514	100%	351	100%	4,895	100%	474	100%
PERCENT BY SEX		81%		19%		91%		9%

Source: Equal Employment Opportunity Commission, Local Government Information System, 1976.

Table V-10

BART EMPLOYMENT IMPACT ON MINORITY OPPORTUNITY
BY JOB CATEGORY, 1976

	BART				AC Transit and MUNI			
	White		Minority		White		Minority	
Job Categories	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total
Officials/Administrators	207	19	88	12	142	5	27	1
Professionals	159	14	57	8	145	5	135	5
Technicians	32	3	14	2	119	4	81	3
Protective Service	49	4	38	5	112	4	39	1
Paraprofessionals	15	1	11	1	9	1	2	1
Office/Clerical	99	9	88	12	379	14	191	7
Skilled Craft	457	41	324	43	431	16	133	5
Service/Maintenance	97	9	130	17	1,398	51	2,067	77
TOTAL	1,115	100%	750	100%	2,735	100%	2,676	100%
PERCENT BY RACE		60%		40%		51%		49%

Source: Equal Employment Opportunity Commission, Local Government Information System, 1976.

Table V-11

BART EMPLOYMENT IMPACT ON FEMALE EMPLOYMENT OPPORTUNITY
BY JOB CATEGORY

	BART				AC Transit and MUNI			
	Male		Female		Male		Female	
Job Categories	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total
Officials/Administrators	288	19	7	2	161	3	8	1
Professionals	179	12	37	11	258	5	23	5
Technicians	46	3	0	0	195	4	5	1
Protective Service	68	5	19	5	151	3	0	0
Paraprofessionals	16	1	10	3	10	1	1	1
Office/Clerical	46	3	141	40	217	4	353	69
Skilled Craft	683	45	98	28	564	12	0	0
Service/Maintenance	188	12	39	11	3,345	68	120	23
TOTAL	1,514	100%	351	100%	4.901	100%	510	100%
PERCENT BY RACE		81%		19%		91%		9%

Source: Equal Employment Opportunity Commission, Local Government Information System, 1976.

2. Opportunity by Race or Ethnicity

Total transit employment with BART includes 3,381 workers classified as minorities, i.e., Black, Spanish-American, Asian, American Indian, or other nonwhite. BART experiences 40.2 percent minority participation in its work force. Without BART, the minority participation in the three-county transit work force would total 49.0 percent.

In hiring an entirely new work force, BART was able to improve the job status of many minorities subsequently in its work force and employ a higher percentage of minorities than is representative of the population. Table V-9 summarizes the racial characteristics of employees by salary level.

It appears that the older bus systems have a greater minority participation rate, perhaps as a result of entry level positions in driver and mechanic roles, which have been perceived as available to minorities (and males) traditionally. BART, on the other hand, has presented the higher technology image, which may have discouraged application by the minorities without a technical education. As a result of early entry and advancement, minorities are far more pervasive within the bus systems.

3. Permanent Employment Impacts by Job Category and Salary Level

BART permanent employment data by job category and salary range provide a different impression of the employment opportunity differential between BART and older agencies, especially for minorities and women. Tables V-8 through V-11 summarize these data. No cross-tabulation for salary and job category was available. Certain anomalies are undoubtedly due to different job classifications among the transit agencies.

The segmentation of the work force by job category makes clear a strong male predominance in both work forces, with women best represented in office and clerical assignments. In both BART and the other agencies, there was stronger minority representation in operating jobs than the administrative.

a. Officials/Administrators

BART classifies 15.8 percent of its employees as officials or administrators. AC Transit and MUNI consider only 3.1 percent of their work force in this category. At BART, 70 percent of these administrators were white and 98 percent were male. By contrast, the other transit systems reported 85 percent white and 95 percent male.

b. Professionals

In the professionals category, nearly 74 percent were white at BART, and 83 percent male. AC Transit and MUNI reported 92 percent of their professionals male, and 52 percent white. While the traditional male dominance of the transit industry was even more evident at the bus transit agencies, the minority representation was far greater.

c. Technicians

BART reported nearly 70 percent of its technicians were white and all male. Only 60 percent were white in the other public agencies; AC Transit and MUNI also reflected nearly total male predominance, 97.5 percent.

d. Protective Service, Paraprofessionals and Skilled Craft

Men hold 85 percent of the protective services, paraprofessional and skilled craft positions at BART. Fifty-eight percent of these positions are white. At AC Transit and MUNI, virtually 100 percent are male, and 76 percent are white.

e. Office Clerical

At BART, 75 percent of the office and clerical staff are female and 53 percent are white. At AC Transit and MUNI, 62 percent were female and 66 percent white.

f. Service and Maintenance

At BART, 83 percent of all service and maintenance positions were held by men and 57 percent by minorities. At AC Transit and MUNI, 99 percent were held by men and 76 percent by whites.

g. Salary Levels

Salary levels at BART are generally higher than at the other public agencies. The mean annual salary at BART is over $16,000, while it is several thousand dollars less at the other agencies. In general however, BART minority employees do not fare as well as whites in terms of salary levels, the most marked inequity being in the uppermost category of salaries, over $25,000 per year, in which more than six times as many whites as minorities are employed.

AC Transit and MUNI are similarly consistent in the distribution of their white and minority work force over salary scales. The tilt of favor, however, is toward the minorities, 47.5 percent

of whom receive more than $16,000 per year. Only 42.9 percent of the whites are in these categories. Still, the top salaries, $25,000 per year or more, are received by twice as many whites as minorities.

The difference between BART practices and those of the older bus systems is evident in the salaries paid female employees. Almost three-quarters of the female employees at the bus systems earn less than $13,000 per year. By comparison, only 18.5 percent of BART's female employees earn less. Over 40 percent earn more than $16,000 per year at BART, while fewer than five percent at the older agencies earn that much.

4. Minority and Female Opportunity on the BART Work Force

The statistical review of employment data by race and sex suggests that BART -- as a new agency, regional in nature, of high technology origins and free from traditional patterns of employment --has been able to achieve a greater record in hiring females, rewarding them, and placing them in positions of responsibility, than the traditional urban bus systems. The fact that the bus systems have the largest share of their employees in traditionally male trades and protected by unions may contribute to the higher male representation.

Both BART and the bus transit agencies have been active employers of minorities.

In addition to evaluating the composition of the BART work force relative to the work forces of older transit agencies in the region, the advancement opportunity and responsibilities associated with minority employees within the BART work force were also pursued. As described earlier, a random sample was taken of minority employees at BART and case studies were drawn from a subset of that sample who agreed to be interviewed. The case studies were not expected to be representative of all BART minority employees, but rather to provide a focus for discussion with the personnel officers of other transit agencies to evaluate whether similar employees would have done as well elsewhere. Thirteen case studies were prepared.

BART permanent minority employees represented by the sample received regular raises and promotions. All employees had received several raises and all but one employee had received at least one promotion, usually more. The one exception was an employee with a three-year grammar school education.

In this sample BART minority females were employed in "nontraditional female jobs" and do well. One female in the sample has been employed at BART four years. She began as Transportation

Worker I at $4.68 an hour, and is now Foreman II at $10.06 an hour. Another female began employment at BART three years ago as Transportation Worker I at $4.68 an hour. She is currently a Maintenance Dispatcher at $8.43 an hour.

All but two of the 13 minority employees interviewed had attended at least one in-service training course, and often more. The two clerical persons in the sample had not participated in in-service training.

Of the case studies, which, for disclosure reasons, remain confidential, 10 were high school graduates, three had associate degrees (two years of college) and one had less than a grammar school education. Additionally, five employees had some type of specialized training other than college before BART employment. This specialized training usually was technical and in the electronics field.

In interviews with management at other transit agencies, the consensus was that, in general, BART employees, regardless of sex or race, have been better paid and promoted faster than the employees of other Bay Area transit operators.

BART emphasizes in-service training more than other Bay Area transit operators. On-the-job training, with little or no in-service training, was the general practice among other transit operators.

Civil service regulations or union agreements set salaries for most transit operator employees. At one operator, all workers began at the entry level and could only be promoted "through the ranks" on the basis of examination, and not necessarily on the basis of job performance. At another, promotion was based on seniority. Overall, BART employees were promoted faster than they would have been with other agencies. This phenomenon may also relate to BART's relative newness and the absence of entrenched personnel policies.

Women held more "nontraditional" jobs at BART, were promoted faster and paid better. Other transit operators were beginning to fill vacancies in "nontraditional" female jobs with women, as part of their affirmative action programs.

VI. CONCLUSIONS AND IMPLICATIONS

The purpose of this study has been to evaluate the economic impacts of BART's capital and operating expenditures. The nature of the impacts is defined by two distinct functions of major expenditures. One impact stems from public investment in the construction of a rapid transit system -- an investment of significant magnitude. The second impact relates to continuing expenditures for rapid transit service. Both types of expenditure have an impact on regional output, employment, income and employment opportunity.

The conclusions from this research also serve several purposes. In an historical context, the findings measure some of the impacts which BART's construction and operation have had on the San Francisco Bay Area. To the extent BART's technological characteristics can be generalized to represent a generic rapid transit mode, the findings also permit a comparison of the potential economic impacts of a comprehensive rapid transit system with the incremental improvements of bus transit service. But even that comparison, if valid, is conducted in the geographical context of an unusually well-balanced regional economy.

Although the set of necessary conditions for transferability will be difficult to meet, the potential application of these findings elsewhere, at the time a region decides to invest in improved regional transportation, in the long run, is probably the most important purpose of this analysis. To accommodate this application, the findings of the study are considered in the context of current transportation investment policies for urban mass transit.

Any policy justification based on expenditure impacts, however, must recognize a fundamental of economic impact analysis. The economic effect of investing $1.5 billion in any region's infrastructure is going to be substantial, regardless of whether or not the object of that expenditure is a rapid transit system. An investment of the same magnitude in another type of infrastructure, such as a wastewater treatment facility, may have a similar effect on the regional economy, or even a greater effect.

In economic terms, the only distinctions of an expenditure in rapid transit are the specific economic sectors which are affected, and the level of that effect. Investment in rapid transit may also provide the region an opportunity to maximize the uses of its labor resources through improving accessibility to employment and reducing the costs of transportation. It may

also enhance the region's competitive advantage through improving a region's image. Otherwise, the investment in rapid transit, to the economist, represents just another public works project.

The expenditure impacts of BART are among the most dramatic. But the findings of this study are as relevant to the phrasing of the question concerning transit's economic impacts as providing the answer.

A. The Impacts of Rapid Transit Investment on the Regional Economy

1. Regional Output and Employment

The region's economy can be described in terms of its sales, income and employment. Introducing $1.523 billion to the regional economy to build and equip a rapid transit system stimulated nearly $3.1 billion of direct and indirect economic activity within the region, with a total employment impact equivalent to over 75,000 person-years. These impacts are favorable economic impacts, and large ones. Because of the size and strength of the Bay Area regional economy, however, they do not represent large relative impacts on the regional economy.

Table VI-1 summarizes the sectors of the economy affected by the capital expenditures and the magnitude of effects.

The amount of employment generated by transit construction and procurement will vary, depending on the nature of the proposed transit system and the regional economy in which it is built. In BART's case, over the 12-year construction period it is estimated that 30,645 person-years of employment were generated by direct expenditures alone. Each $50,000 of the total construction cost generated a person-year of direct employment. Somewhere in the region's complex economy, another 1.5 person-years of employment were required to support that direct job.

2. Impacts on Household Income

BART's construction and equipment resulted in an increase in minority household income of nearly $116 million; nonminority household income increased $811 million from construction expenditures.[1] This represents about 54 cents in personal

[1] BART's direct payroll was small; the indirect and induced incomes, which are responsible for the largest amount of the impact, result from the wages paid by contractors and the income generated by consumer purchases.

Table VI-1

IMPACT ON SALES AND INCOMES
OF BART CAPITAL EXPENDITURES 1964-1974
(Millions of 1976 Dollars)

Sector	Direct	Total
Agriculture and Mining	$ 0.000	$ 17.003
Construction	907.656	921.122
Manufacturing	71.461	420.061
Transportation and Utilities	0.980	113.827
Trade	0.000	165.590
Finance, Insurance and Real Estate	9.164	154.399
Services	209.030	421.148
Personal Income	1.651	926.798
Minority	0.347	115.598
Nonminority	1.304	811.200
Total Regional Sales and Income	1,199.940	3,140.088
Regional Imports	263.380	1,220.398
Transfers (Land Acquisition)	60.424	
Total Investment Demand	$1,523.746	
TOTAL EMPLOYMENT IMPACT IN PERSON-YEARS	30,645	75,009

Source: McDonald & Grefe, Inc.

income for every dollar the residents or businesses of the region paid in taxes for the bonds and interest which financed BART.

The percentage of the total personal income -- from direct, indirect and induced expenditures -- received by minority households was 12 percent, a percentage not inconsistent with the socioeconomic profile of the region, although substantially lower than the percentage of minority household income resulting from BART and the joint venture's direct payments. Twenty-one percent of the total personal income generated directly by expenditures in BART's construction was received by minority households.

3. Employment Opportunity

BART's commitment to equal employment standards in its construction contracts appears to have had an impact on minority participation in the unionized construction trades and crafts which built BART. The residual impact on long-term employment opportunity for minorities was less certain.

The increase in minority employment was largely in the laborers' job classification, which does not require an apprenticeship period, nor is it considered a craft by the unions. As a result, the residual effects of this employment opportunity for minorities were not substantial, i.e., after BART was completed, many of the minority workers who had been employed were not necessarily more easily employable in the future as a result of improved job skills. This does not imply, however, that the 30,695 person-years of direct employment for constructing BART were inconsequential.

4. Inflation in Construction Wage Rate

There was no evidence that construction wage rates increased as a result of the construction, despite BART's construction work force totalling nearly six percent of the regional construction work force.

5. Transferability of Capital Expenditure Impact Findings

Transferability of the findings is limited by the specific character of BART. BART is different from the rapid transit systems presently being proposed elsewhere. BART is a high-technology system which encountered costs and problems which probably will not be repeated in future systems in the 1970s and 1980s (although other systems will have their own unique problems). Further, BART is a high-speed regional rail transit system of 71 miles, built in a highly developed and cohesive region consisting of several city centers.

To use the findings to measure the types of impacts which rapid transit construction could have on a region, the nature of the proposed system and its expenditures would have to be similar to BART's. The economy of the region in which it would be built would also have to be similar to the San Francisco Bay Area.

Ideally, the relative findings on the economic impact of capital investment in BART (as rapid transit) and the NBA (as bus transit) would be transferable for purposes of evaluating the economic implications of a choice between modal alternatives. The definition of the NBA, in which virtually no capital investment would be required (but would provide a lower level of service) diminishes the relevance of these conclusions. Most regions currently seeking a better understanding of the economic impacts of transit investment would be choosing between alternative modes or technological systems to serve an increased level of transit patronage for each alternative. This choice between alternatives would entail a larger capital cost for even the low-capital equivalent alternative.

B. The Impact of Rapid Transit Operating Expenditures on the Regional Economy

1. Regional Output and Employment (Annual)

In evaluating the economic impact of a proposed rapid transit system on a regional economy, operating cost impacts can be subordinated in the public decisionmaking process to the capital investment impacts. Yet the economic benefits of operating a transit system will become a permanent part of the regional economy, even if less dramatic than construction.

In the case of BART, the price of providing regional transit service with BART rather than with bus transit agencies generates nearly $149 million of regional sales and income annually. This figure includes the direct and indirect expenditures required for BART's $59.8 million annual operating budget, less the $13.1 million operating budget hypothesized for the NBA. (The multiplier effect from BART operating expenditures alone is 3.19, although the BART impact -- as opposed to BART expenditures -- is lower, because of the difference between BART's expenditures and those which would have occurred otherwise.)

The employment impacts of BART over the NBA total 1,265 direct jobs and a total of 3,017 jobs within the region. This reflects a direct employment multiplier of one job (or person-year of employment) for each $32,000 of BART's operating budget, or total direct and indirect employment of one job for each $15,000. Table VI-2 compares the employment multipliers of BART with those of the NBA.

Table VI-2

BART AND NBA SALES AND EMPLOYMENT MULTIPLIERS FOR OPERATING EXPENDITURES

Transit Agency	Total Sales & Income[1]	Direct Employment[2]
BART Operations	3.19	31.18
AC Transit Operations	3.22	45.86
San Francisco MUNI	3.18	46.31
Greyhound Western (Local Only)	3.03	41.34

[1] Regional output required to support one dollar of operating expenditures.

[2] Number of person-years of employment equivalent to $1 million of operating expenditures. No indirect figure is given, since it is so heavily dependent on regional economic structure.

Source: McDonald & Grefe, Inc.

2. Employment Opportunity

Employment opportunity for minorities and women among regional transit agencies appears to have been enhanced by BART's operations. Overall, 40 percent of BART's permanent work force is minority and 19 percent female, and its salary schedule is relatively generous.

The most evident impact in employment opportunity is the larger female participation in BART's work force then in the non-BART transit work forces and its high level of compensation and responsibility. Almost three-quarters of the female employees at AC Transit and MUNI earn less than $13,000 per year, for instance, while over 81 percent of BART's female employees earn more. The effect of BART, as a new employer and a transit agency imbued with a modern concept of technology, management, marketing and research may account for this performance.

3. Regional Income

The total annual effect of BART's operational expenditures on regional household incomes is not significant relative to the regional economy, at less than two-tenths of one percent. Nonetheless, BART expenditures generate almost $52 million in personal income each year, and almost 22 percent of the income goes to minority households.

4. Transferability

The transferability of the economic impacts of BART's operating expenditures -- like the capital expenditure impact findings -- are conditioned by the definition of the transit network which would have served the region in the absence of BART, the NBA. Assuming very little additional operating expense by AC Transit, MUNI and Greyhound ($13.1 million annually) would have provided an adequate alternative level of service reduces the relevance of any findings to locations with an extensive background transit network similar to that of the Bay Area.

The findings suggest that each dollar spent on rapid transit is very similar to a dollar spent on bus operations in the magnitude of its impact on the sales and income of the region, but does not yield as much employment. On the other hand, the magnitude of BART's expenditures -- almost five times higher than the NBA operating expenditures -- is counter to conventions of traditional cost-effectiveness. Capital intensive rapid transit systems have been assumed to experience operating efficiencies relative to labor-intensive bus systems.

If fuel costs, congestion, BART's reliability and BART's service levels all increase simultaneously in the Bay Area in the future, the conventional engineering-economics argument may still prevail. In the interim, the operating cost of BART should not be considered indicative of the level or even type of costs of the new systems of the 1970s. For example, while transit planners may want to note the high proportion of BART's budget committed to maintenance and repair, it is probably not representative of the costs other systems will bear and, similarly, it distorts the transferability of the total economic impacts.

If caution is used in discounting the unique character of BART, of the NBA, and of the region's economy, the regional output multipliers and the employment multipliers could be used as comparative benchmarks when evaluating potential impacts elsewhere.

The methodology of input-output analysis is certainly transferable to the evaluation of potential impacts of alternative transportation systems for a region and, with proper use, can be highly successful in guiding a coordinated urban and economic development strategy.

C. Implications of Expenditure Impacts for Economic, Urban and Public Policies

The implications of these findings do not bear solely on transportation investment choices, but the transferability of the findings is limited because of the very particular characteristics of the Bay Area and BART.

For instance, the use of these findings in deciding among alternative future transit systems for other urban areas must consider the unusual characteristics of BART. If BART were the modal choice throughout its potential service area, it would serve only nine percent of the total regional trips. It currently serves one-quarter of these trips. Hence, the transportation benefits to be gained from BART are far more narrowly defined than the economic impacts and financial burden.

The economic impacts, serving a broader area, may become the most visible of all impacts. Appropriately, economic development potential is currently emerging as an important criterion in federal funding policies for new transit systems. The findings of BART's impacts, and the methodology used, provide valuable insight into the potential local or federal government could exploit in leveraging its financial investment to provide the greatest possible impact on a region.

1. Transit As an Element of Economic Development

If decisions to fund transportation investments are to be made on the basis of economic development objectives, the emergence of these objectives should be recognized in a comprehensive urban development policy which governs federal or local transit investment. Otherwise public agencies, each pursuing projects which meet both their own objectives and those of economic development, may fail to achieve a mutually supportive investment in urban revitalization. For example, federal transit investment decisions today are made by comparing transit alternatives for a city with each other and with those of other cities. Thus even with consideration of potential economic development impacts, the choice does not respond to whether a better investment in economic development might be another capital-intensive program altogether supported by a comprehensive low-capital transit system.

There is no question that adequate transportation capacity is a necessary condition for maintaining urban vitality, but it is not a sufficient condition. Therefore, transportation should be supportive of a broader economic development strategy, rather than making transportation decisions independent of economic, housing and urban policy. Although some favorable impacts of BART, at this time, are economic in nature, that does not sanction transit as the vehicle for urban revitalization.

2. Optimizing the Impact of Local and Federal Investment

The input-output methodology of this study illustrates how the economic sectors a policymaker might want to impact can be identified in advance of an investment decision. Alternative public investments can be evaluated to determine a program of investment, including transit, which will optimize the economic impact on those sectors. Manufacturing or service sectors already dominant in a regional economy, or with high unemployment rates, could be reinforced by planning the object of federal expenditures. After determining the minimum level of transportation service necessary to sustain urban growth -- or stem decline -- the transit alternatives capable of providing this level of service could be described. If the costs of these alternatives were less than available federal resources from housing, economic development, urban development or transportation authorizations, an optimal means of investing the remainder could be identified.[1] This investment strategy

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[1] A linear programming formulation can yield the optimal allocation of investment to maximize an objective such as gross regional product or employment. See linear programming analysis in Everard Lofting, "A Multi-Sector Analysis of the Impact of Geothermal Development on the Economy of Imperial County, California," January 1977.

should then emphasize infrastructure improvements which improve the competitive position of the region, as well as maximize the expenditure impact.

Under this strategy, capital-intensive transit investments might not be part of a development program. As a public investment, transit would be evaluated against other nontransit public works, rather than against buses, to determine how to increase its economic impact.

One opportunity of a coordinated economic development policy is the recognition that a compelling public policy or social objective can be met by targeting federal investment to improve the use of currently underutilized regional resources, whether capital resources, such as empty plants, or human resources, such as the unemployed.[1]

3. Focusing the Objectives of Transit Investment

Judging potential transit investments by economic development criteria focuses the purpose of transportation policy. The same narrowing of focus should occur concerning the local problems for which the federal government will fund solutions.

Broad transportation objectives cannot be fulfilled in a period of decreasing capital funds. Regional rapid transit systems will no longer be implemented as a single project. Despite the federal emphasis on regional solutions, if only a localized, subregional transit system can be implemented with available funds, then the locus of all other policy considerations should be reduced concurrently.

Evaluating BART's impacts on a nine-county region, for instance, reduces the relative size of impacts and may even mask important conclusions, like employment impacts on unemployed, inner-city youth. Proposed alternative transit solutions should be evaluated on the basis of a smaller geographic region than the normal regional transit agency's jurisdiction, to assure accurate assessment of the effectiveness of a decision on specific policy objectives. In addition to the need to focus implementation strategies on a narrowly-defined geographic area, specific policy objectives for economic development or minority employment opportunity should be conceived.

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[1] Even the cost of a system similar to BART should be recalculated in any benefit/cost analysis to allow for the reduction in social costs when idle productive resources are employed.

4. Programming Achievement of Objectives

Once narrowly-defined objectives have been formulated, broad policy decisions can be made which will begin the momentum toward achievement. For example, revitalizing an urban economy through an employment-generating public works project, which may be transit. If the specific objective is to enhance the competitive position of an urban area over time, any federal investment plus local match should be directed by a program that reinforces that objective.

The competitive position of a region can be enhanced by providing experience and skills to its work force. In a city with high unemployment, labor represents a resource which can be put to use, trained and equipped, and perhaps even emerge as an export-base industry, while working on a public works project. To improve the probability of achieving this success, a funding commitment should be accompanied by a program targeted at the problem. For instance, competitive bidding processes could be amended to permit an advantage to local industry or business, when implementing a public works project in an economically disadvantaged urban center. Even if the cost of the project increased a modest percent, it could represent an explicit subsidy to improve a city's industrial position in the future, as part of an economic development policy. Input-output analysis of BART's expenditure impacts illuminated the ease with which public investment can escape the region's economy. This tactic would be sound, only if the policy governing transportation investment were economic development.

Similarly, if enhancing employment opportunity is to be an objective in transportation investment, a federal effort should be made to assure that federal dollars are spent to improve the long-term employment potential of any workers on the project. Training and apprenticeship programs for minority youth and the unemployed could be made a condition of federal funding commitments to assure that contractors and unions in the future have a greater choice among both experienced and trained minority workers.

5. Transit Alternatives as Economic Alternatives

The implications of this study for federal policy respond to the current interest in transportation's contribution to regional economic development. Transportation decisions made independent of economic development considerations could result in implementation of a system which satisfies all transportation criteria for an urban area, but which, for lack of economic development, fails to experience the projected patronage on the basis of which it was justified. The funding which will be available

for urban development, in light of the increasing costs of all urban services, is limited. Therefore, if federal policy includes economic development and urban revitalization as objectives, they should also become explicit criteria in transportation investment decisions. And as explicit considerations, economic development and urban revitalization should govern the definitions of alternatives themselves, including combining nontransit alternatives with transit alternatives.

APPENDIX A

SAN FRANCISCO BAY AREA INPUT-OUTPUT MODEL METHODOLOGY AND DATA SOURCES

APPENDIX A

SAN FRANCISCO BAY AREA INPUT-OUTPUT MODEL METHODOLOGY AND DATA SOURCES

This appendix describes the procedures and data sources used by the University of California Cooperative Extension to develop input-output models of the nine-county San Francisco Bay Region for the years 1967 and 1974. The basic approach involved utilizing a combination of secondary census data and survey information to systematically adjust national input-output coefficients to reflect the particular economic conditions and trade flows of the San Francisco Metropolitan Region.[1]

Generally, Cooperative Extension has abided by the standard definitions and conventions set forth by the Interindustry Division of the Bureau of Economic Analysis.[2] One exception is that household consumption and income were made endogenous to the models. However, the practice of linking household income to changes in output (making household income and expenditures endogenous to the model) is not unusual in regional modeling and has been discussed elsewhere.[3]

A. RAS Interindustry Coefficient Adjustment Technique

The RAS or biproportional matrix adjustment technique was the primary method used to incorporate regional economic data and to "balance" the final dollar flow table (i.e., to reconcile inevitable inconsistencies among data sources). The RAS technique has been widely used to update and project input-output

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[1] The nine-county Bay Area includes Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Sonoma and Solano Counties.

[2] U.S. Department of Commerce, Bureau of Economic Analysis, "Definitions and Conventions of the 1967 Input-Output Study" Mimeo, Washington, D.C., August 1974.

[3] For further discussion of implications and applications of endogenous household sectors see Harry W. Richardson Input-Output and Regional Economics, London, Weidfield and Nicolson, 1972 and A. Ghosh, Experiments with Input-Output Models, Cambridge University Press, Cambridge, 1964.

tables.[1] More recently, RAS has been used as a technique for "regionalizing" national tables.[2]

The working hypothesis of the RAS technique is that a region's input-output coefficient matrix (A*) will display a relationship to the national coefficient matrix (A) of the form:

$$A^*=\hat{r}A\hat{s},$$

subject to the conditions:

$$(A^*x^*)k=X^*i=u^*,$$

and where i is the unit summation vector,

$$(A^*x^*)'i=X'^*i=v^*$$

r and s are diagonal matrices of "fabrication" or "substitution" multipliers (from which the technique derives its name) and where x* is a vector of gross regional outputs and X* is the matrix of regional dollar flows. The vectors u* and v* are the observed values of the region's intermediate output (i.e., output used to produce other goods) and intermediate purchases for each industry. In practice, a slightly modified version of this RAS formulation may be used to incorporate survey data or "known" purchases inside the regional coefficient matrix. This modified RAS may be expressed as,

$$A^*=C-\hat{r}(A-C)\hat{s},$$

where C is a matrix of "known" transactions which should be held constant during the adjustment procedure.[3]

B. Input-Output Sectors and Aggregation Procedures

The starting point for both the 1967 and 1974 models was the 1967 national 367-sector dollar flow table. For the 1974 model, a 1972 RAS update of the 1967 model was used as the base table ("A" matrix for the RAS). This 1972 national model was developed by the Lawrence Berkeley Laboratory's (LBL) Regional

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[1] Allen, R.I.G. and W.F. Gossling, Estimating and Projecting Input-Output Coefficients, London; Input-Output Publishing Co., 1975.

[2] McMenamin, David G. and Joseph Haring, "An Appraisal of Non-Survey Techniques for Estimating Regional I/O Models," Journal of Regional Science, Vol. 14, No. 1, 1974, and Morrison, W. I. and P. Smith, "Nonsurvey Input-Output Techniques at the Small-Area Level: An Evaluation", Journal of Regional Science, Vol. 14, No. 1, 1974.

[3] See R.I.G. Allen and J.R.C. Lecomber "Some Tests on a Generalized Version of RAS" (in Allen, ibid.) for a more formal elaboration of both the simple and modified RAS.

Studies Group for the Energy Research and Development Administration in 1976.[1]

The Bay Area table was initially balanced at the 677-sector level using the LBL computer center's "Regional Flow Program." This table was then aggregated to 50 producing sectors for incorporation of survey and export data using the RAS procedure. These 50 sectors were chosen based on three criteria:

- Homogeneity of industrial sales and purchases (using the 88-sector national aggregation as a guideline);
- the regional impact analysis for which the model was initially intended; that is, the sales, employment and income effects of large public investment in transportation facilities; and
- data availability at the regional level. This constraint was mitigated somewhat by a dollar flow survey of sectors where insufficient published data were available.

Table A-1 provides a sector description and bridge by SIC and National Input-Output sector number for each of the 50 final sectors. Table A-2 describes the model column designation. Three final demand vectors were developed: regional investment, government purchases and total regional exports.

Two household sectors, one for minority households (Black, Spanish-surname and native-American) and one for nonminority households were developed to facilitate distribution of economic impacts between social groups in the San Francisco Bay Area.

C. Data Collection Objectives and Sources

The primary data requirements for the RAS procedure are estimates of intermediate output (sales) and intermediate outlays (purchases) for each regional industry (these form the vectors u* and v* described in Section 4). Regional intermediate output can be calculated as gross regional product less output consumed regionally, less total regional exports. Regional intermediate outlays can be calculated as gross regional product less regional value added. Data sources for estimating gross outputs, exports, final demand vectors (goods used by local government, by households and for regional capital formation) and for deriving value added are described below.

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[1] Energy Research and Development Administration, Regional Studies Group, "1972 367 Sector National RAS Update Input-Output Model," Lawrence Berkeley Laboratory, September 1976.

SAN FRANCISCO INPUT-OUTPUT MODEL SECTOR BRIDGE

1967, 1974 S.F. Bay Area Input-Output Model Sector		Equivalent 1967 National 85 Sector Input-Output Model Sector	1967 SIC Codes
1	Ag. Primary Products	01.01-09.00	01-14
2	New Construction, Residential Building	11.01	PT15 PT16 PT17
3	New Construction, Nonresidential Building	11.02	PT15 PT16 PT17
4	New Construction, Public Utilities	11.03	PT15 PT16 PT17
5	New Construction, Highways	11.04	PT15 PT16 PT17
6	New Construction, All Other	11.05	PT15 PT16 PT17
7	Maintenance, Repair Construction	12.00	PT15 PT16 P%17
8	Ordinance	13.00	19
9	Food Processing	14.00	20
10	Fabricated Textile Products	15.00-14.00	21-23
11	Lumber and Wood Products	20.00-21.00	24
12	Furniture	22.00-23.00	25
13	Paper and Allied Products	24.00-25.00	26
14	Printing and Publishing	26.00	27
15	Chemicals, Plastics, Synthetics	27.00-29.00	28
16	Petroleum Refining, Related Industries	31.00	29
17	Rubber and Leather Products	32.00-34.00	30, 31
18	Stone and Clay Products	35.00-36.00	32
19	Primary Iron, Steel Manufacturing	37.00	331, 332, 339
20	Primary Nonferrous Metal Manufactures	38.00	333, 334, 335, 336
21	Metal Containers	39.00	341
22	Fabricated Structural Metal Products	40.00	343, 344
23	Screw Machine Products	41.00	345, 346
24	Other Fabricated Metal Products and Engines	42.00-44.00	342, 347-349, 351
25	Construction and Materials Handling	45.00-46.00	353
26	Metal Working, Special Industrial Equipment	47.00-48.00	354, 355
27	General Industrial Machinery	49.00-50.00	356, 359
28	Office, Computing Machinery	51.00	357
29	Service Industry Machines	52.00	358

Table A-1 (continued)

SAN FRANCISCO INPUT-OUTPUT MODEL SECTOR BRIDGE

1967, 1975 S.F. Bay Area Input-Output Model Sector		Equivalent 1967 National 85 Sector Input-Output Model Sector	1967 SIC Codes
30	Electric Transmission Equipment	53.00	361, 362
31	Electric Lighting Equipment	54.00-55.00	364, 363
32	Radio, TV Communication Equipment	56.00	365, 366
33	Electronic Components and Equipment	57.00-58.00	367, 369
34	Motor Vehicles and Equipment	59.00	371
35	Aircraft and Parts	60.00	372
36	Other Transportation Equipment	61.00	375, 379, 373
37	Professional, Scientific Equipment	62.00-63.00	38
38	Miscellaneous Manufacturing	64.00	39
39	Transportation	65.00	40-47
40	Communications	66.00-67.00	48
41	Utilities	68.00	49
42	Trade	69.00	50-59
43	Banking	70.00	60, 61, 62, 63
44	Real Estate	71.00	65, 66
45	Personal SErvices	72.00	70, 62
46	Miscellaneous Business Services	73.00	73, 81, 89
47	Automobile Repair, Amusements	75.00-76.00	75, 78
48	Medical Services, Nonprofit Organizations	77.00	80, 82
49	Government Enterprises	78.00-79.00 (ex.c. 79.01)	
50	Local Government Transit	79.01	

Table A-2

MODEL COLUMN DESCRIPTIONS

Columns 1 through 50	Are identical to Rows 1 through 50
Column 51	Minority Personal Consumption Expenditures
Column 52	Nonminority Personal Consumption Expenditures
Column 53	Total Intermediate Regional Sales to Firms (sum of columns 1 - 50)

Final Demand Sectors:

Column 54	All Regional Exports
Column 55	Regional Capital Formation including Inventory Change
Column 56	All Government Purchases Total by Regional, Federal, State and Local Government Agencies from Bay Area Firms
Column 57	Gross Regional Product

1. Gross Regional Outputs

The primary sources of gross regional outputs were the 1967 and 1972 Department of Commerce Censuses of Manufactures, Selected Services, Retail and Wholesale Trade, Construction and Mineral Industries. Where census coverage was incomplete, and to ensure full coverage at the four-digit SIC level, 1967 and 1972 County Business Pattern Wage Data were used (in the form of regional wage to output ratios) to develop outputs at the 367 Input-Output Sector Level.

Agricultural production totals were tabulated from the 1967 and 1972 Agricultural Commissioner reports for the nine Bay Area counties.

Wholesale, retail and transportation margins, upon which the "outputs" of these three sectors are based, were obtained from the U.S. Bureau of Economic Analysis (BEA) and from Sheppach's projections of final demand by state for 1970 and 1980.[1]

Construction outputs were estimated by type of construction rather than by SIC in accordance with BEA convention. Total construction sales were first estimated for the Bay Area using wage productivities and were then distributed by "type" of construction based on the state's 1972 composition of construction based on the state's 1972 composition of construction output (i.e., residential, utilities, highways, etc.).

All 1972 outputs were updated to 1974 using payroll ratios developed from California State Employment Development Report 127 for 1972 and 1974.

Sales and expenditures for Bay Area transit services were compiled from the Metropolitan Transportation Commission's reports mandated by the Transportation Development Act.

2. Regional Exports

The most important source of deviation between regional and national purchasing patterns (or the technical coefficients for these patterns) is the large proportion of sales and purchases made outside the region. While national imports and exports are typically a small fraction of total output, regional imports may be a major component of intermediate outlays and the majority of output may be sold outside the region.

A combination of three basic sources was used to estimate Bay Area import and export flows: the 1972 Census of Transportation Survey of Commodity Flows; Cooperative Extension's 1974 Dollar

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[1] Raymond C. Scheppach, Jr., State Projections of the Gross National Product, 1970, 1980, Lexington Books, 1972.

Flow Survey; and estimates from the LBL "Regional Flow Program."

The Commodity Transportation Survey conducted by the Census Bureau is based on a statistical sample of goods shipped out of states and production areas[1] measured in tons and designated by state or production area of destination. These data, in their published form, have several limitations which were overcome by utilizing a "Commodity Attribute File" developed by the MIT Center for Transportation Studies to translate five-digit TCC code ton-values into 1972 dollars.[2] Disclosure gaps in the CTS survey were filled in using a statistical algorithm.[3] These initial estimates were then reconciled with four, three and two-digit TCC code subtotals to provide a consistent, complete set of import and export values for the San Francisco production area. These flows were then bridged from 1972 TCC code to 1967 SIC code which were in turn grouped by BEA Input-Output Sector. These net export values for manufactured and mining products provided one of several basic data sources for estimating Bay Area regional export flows for 1974.

Estimates of exports obtained from Cooperative Extension's Dollar Flow Survey provided a second source of export-flows. Survey data were especially useful where a sector was dominated by one or two large firms.

Finally, a complete vector of export estimates was obtained from LBL's "Regional Flow Program" which calculates regional exports based on the assumption that all local demands for goods and services would be met before goods were exported. This set of regional export estimates provided a "minimum" or low range of export values for all industry sectors.

3. Regional Final Demand

The Government Purchases Final Demand vector includes purchases made by federal, state and local governments from regional firms for use in San Francisco Bay Area operations. State and local government budgets were obtained from the 1972 Census of Governments. Federal government expenditures by

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[1] The San Francisco CTS Production Area is exactly contiguous with the nine-county study region.

[2] Samuelson, Ralph A. and Paul O. Roberts, A Commodity Data File for Use in Freight Transportation Studies, Massachusetts Institute of Technology Center for Transportation Studies, CT #75-20, November 1975.

[3] "Disclosure Gaps" refer to data withheld to protect the confientiality of individual firms.

county were developed from the U.S. Office of Employment Opportunity's Federal Outlays in Summary report. These budget totals by type of expenditure (education, health and welfare, devense, etc.) were used to develop preliminary regional outlays based on national purchasing patterns which were in turn adjusted for regional import/export flows using the "Regional Flow Program." These regional final demand vectors were then checked against Sheppach's estimates of California final demand vectors for 1970.[1]

Final demand for regional capital formation includes all goods purchased locally for investment by San Francisco Bay Area firms. Total regional capital expenditures by two-digit SIC were obtained from the 1967 and 1972 Census of Manufactures. Regional purchasing patterns were developed from the BEA's report on "Interindustry Transactions in New Structure and Equipment, 1967." These preliminary expenditures were adjusted for regional import/export flows using the "Regional Flow Program" and were then checked against Sheppach's estimates of state final demand. New residential and industrial plant construction estimates were based on the 1967 and 1972 Census of Construction Industries. Net inventory changes were estimated using the "Flow Program" and values for inventory change from the 1967 and 1972 Census of Manufactures.

4. Household Sectors

Two household sectors, one for minority residents (including Black, Spanish-surname, and native American families and individuals) and the other for nonminority households, were developed for this model. The distribution of employment by ethnic group and occupation for two-digit SIC classifications was obtained from a special printout of the U.S. Equal Employment Opportunity Commission EEO-1 summary for 1967 and 1974. A distribution of income received from each industry sector was developed using average wages by occupation for minority and nonminority groups. When combined with BEA estimates of personal income by industry source by SMSA and county, these income distributions provided the minority and nonminority household rows of income by industry source.

The columns of household personal consumption expenditures for regionally produced goods and services were developed from the U.S. Bureau of Labor Statistics' "Urban Family Budgets" and from the preliminary results of the 1972 Consumer Expenditure Survey. A "regionalized" consumption vector was obtained using a computer program developed by Cooperative Extension. The program contains typical 1972 budgets for western families in three income brackets which are in turn bridged to 1967

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[1] op.cit.

input-output sectors of purchase origin after trade and transportation margins have been reallocated to those sectors (retail and wholesale trade, and transportation services). Trade and transportation margins used in this program were obtained from Sheppach, while the distribution of consumption purchases by industry was developed from the BEA's "Industrial Composition of Personal Consumption Expenditures in Purchaser's and Producer's Prices."

Different distributions of income among minority and nonminority families accounted for the major variations in consumer purchasing patterns between the two groups. Other minor adjustments for purchasing patterns by ethnic group were based on the Bureau of Labor Statistics Consumer Expenditure Survey results for Black families.

5. Cooperative Extension Dollar Flow Survey

A mail survey was conducted by Cooperative Extension to obtain data on regional import and export sales in selected industry sectors where secondary data were limited. The modest response rate to the initial survey effort (6 percent) can be attributed to the difficulty of obtaining regional flows of goods from a firm's central administrative office. Records of transactions are simply not kept on a regional basis. A follow-up survey utilizing a shortened questionnaire form resulted in an improved 19 percent mail response rate. Further follow-up efforts were curtailed when data on regional import/export flows became available from the 1972 Commodity Transportation Survey. Nevertheless, the tabulated survey results provided useful export data for many sectors, since the larger firms which accounted for a major share of output and exports in a particular industry tended to respond more readily to the survey.

D. Construction Subsector Methodology

Developing input-output construction sectors at the regional level poses particular problems. Although the National I-O model classifies over 48 construction activities in separate sectors, these sectors are based on types of construction and cannot be bridged into SIC categories (which are based on contractor classifications). (Construction wages are available by SIC only.) As a result, data limitations prevent the incorporation of more than a few construction sectors into the regional input-output table.

To overcome this limitation the regional table of direct requirements (a matrix) can be decomposed into a group of

detailed construction sectors which sell only to investment final demand. In effect, special subsectors are introduced after the model is completed and they do not affect the total requirements (multipliers) of the original sectors.

This result uses the standard I-O formulation:

$$Ax + F = X$$

Where: X is a (nxl) vector of regional outputs
F is a (nxl) vector of regional fine demand
A is an (nxn) matrix of direct requirements (intermediate regional demand)

Decomposing the A matrix into our special subsectors (a*) which sell only to public investment final demand and all other sectors (A), the above equation becomes:

$$\begin{bmatrix} 0 & 0 \\ a^* & A \end{bmatrix} \begin{bmatrix} x^* \\ X \end{bmatrix} + \begin{bmatrix} f^* \\ F \end{bmatrix} = \begin{bmatrix} x^* \\ X \end{bmatrix}$$

Where: a* are the technical coefficients of the transit construction sectors
f* is the investment final demand for transit construction
x* is the output of the transit construction sector

and, A, F, and X are similarly defined for all other sectors in the regional economy.

The above equation can be rewritten:

$$Ax + F = X$$

$$\text{and } a^*x^* \text{ of}^* = x^*$$

Thus, the final demand multipliers for the transit construction sectors can be introduced separately, and the other regional economic sectors are not affected:

$$F + X(I-A)^{-1}$$

$$f^* = x^*(I-a^*)^{-1}$$

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APPENDIX B

TABULATION OF BART CAPITAL COSTS

APPENDIX B

TABULATION OF BART CAPITAL COSTS
List of Tables

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Table B-1

TOTAL CAPITAL EXPENDITURES : AMOUNTS BY YEAR

	TOTAL CONTRACT AMOUNTS AND PERCENT		
1964	$	1404755.43	.09 PCT.
1965	$	46606037.60	3.06 PCT.
1966	$	158456585.84	10.40 PCT.
1967	$	144187060.04	9.46 PCT.
1968	$	244734060.57	16.06 PCT.
1969	$	292772942.52	19.21 PCT.
1970	$	159835914.97	10.49 PCT.
1971	$	130470342.98	8.56 PCT.
1972	$	101129628.33	6.64 PCT.
1973	$	90008873.79	5.91 PCT.
1974	$	85488873.96	5.61 PCT.
1975	$	67274135.39	4.41 PCT.
1976	$	1605455.09	.11 PCT.
TOTAL	$	1523974666.51	100.00 PCT.

Source: McDonald & Grefe, Inc.

Table B-2

TOTAL CAPITAL EXPENDITURES : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1A0011	TOTAL AMOUNT = $ 4785153.57												
			88343.	2251305.	2153369.	290571.	44005.						
CONTRACT 1A0021	TOTAL AMOUNT = $ 5586253.30												
			28166.	1671337.	3360592.	295150.	31009.						
CONTRACT 1A0023	TOTAL AMOUNT = $ 58079.89												
												58080.	
CONTRACT 1A0031	TOTAL AMOUNT = $ 4255426.55												
			22403.	1684244.	2313364.	214050.	21365.						
CONTRACT 1A0041	TOTAL AMOUNT = $ 6466241.60												
			1235815.	3739403.	1130187.	357809.	3028.						
CONTRACT 1A0042	TOTAL AMOUNT = $ 2454757.45												
			93803.	2085207.	147712.	128036.							
CONTRACT 1A0051	TOTAL AMOUNT = $ 5576507.64												
			41069.	2446296.	2416585.	572300.	100258.						
CONTRACT 1A0052	TOTAL AMOUNT = $ 661984.80												
				100684.	511600.	49702.							
CONTRACT 1A0061	TOTAL AMOUNT = $ 461017.00												
			150656.	310362.									
CONTRACT 1A0063*	TOTAL AMOUNT = $ 10769001.00												
				3589667.	3589667.	3589667.							
CONTRACT 1A0064	TOTAL AMOUNT = $ 1144164.86												
				71434.	1001480.	71251.							
CONTRACT 1A0071	TOTAL AMOUNT = $ 1686991.79												
				76308.	1238774.	291909.	80000.						
CONTRACT 1A0072	TOTAL AMOUNT = $ 2629979.84												
					682964.	1284891.	434101.	128024.		100000.			
CONTRACT 1A0074	TOTAL AMOUNT = $ 161045.54												
										144572.	15973.	500.	
CONTRACT 1A0077	TOTAL AMOUNT = $ 4894217.81												
											2710383.	2183834.	
CONTRACT 1A0081	TOTAL AMOUNT = $ 3078572.44												
						699000.	2185635.	184585.	10353.				
CONTRACT 1A0091	TOTAL AMOUNT = $ 1789726.92												
						398671.	1190593.	195713.	3500.	1250.			
CONTRACT 1A0092	TOTAL AMOUNT = $ 1397139.80												
					540289.	792410.	64440.						
CONTRACT 1A3091	TOTAL AMOUNT = $ 1233428.08												
							674871.	484586.	73972.				
CONTRACT 1A3424	TOTAL AMOUNT = $ 120537.59												
									102048.	18489.			
CONTRACT 1A3421	TOTAL AMOUNT = $ 98067.96												
							76855.	21213.					
CONTRACT 1A1021	TOTAL AMOUNT = $ 1030582.26												
							430664.	394097.	205821.				
CONTRACT 1A1011	TOTAL AMOUNT = $ 4539370.92												
					523135.	2280889.	1036997.	698350.					

Source: McDonald & Grefe, Inc.

Table B-2 (continued)

TOTAL CAPITAL EXPENDITURES : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1A3051	TOTAL AMOUNT = $	1281721.40										
			196141.	604491.	404978.	76112.						
CONTRACT 1A3011	TOTAL AMOUNT = $	1145525.37										
			175966.	714134.	196536.	58393.						
CONTRACT 1A3021	TOTAL AMOUNT = $	1207183.18										
			249480.	645060.	214276.	96867.	1500.					
CONTRACT 1A3061	TOTAL AMOUNT = $	1054102.96										
			314433.	597269.	35973.	106428.						
CONTRACT 1A3041	TOTAL AMOUNT = $	1015161.41										
			408573.	492613.	20596.	80660.	12719.					
CONTRACT 1A3042	TOTAL AMOUNT = $	1088854.60										
			376588.	612570.	30366.	69330.						
CONTRACT 1A3081*	TOTAL AMOUNT = $	1240000.00										
		1240000.										
CONTRACT 1B0031	TOTAL AMOUNT = $	15235074.44										
			4993455.	9365566.	926054.					250000.		
CONTRACT 1B0033	TOTAL AMOUNT = $	1400674.22										
		719423.	522018.	84236.	75000.							
CONTRACT 1B0041	TOTAL AMOUNT = $	2571956.73										
		870512.	1542244.	159101.								
CONTRACT 1C0021*	TOTAL AMOUNT = $	30597999.00										
		10199333.	10199333.	10199333.								
CONTRACT 1C0041	TOTAL AMOUNT = $	31625432.35										
	5128500.	12647470.	5826273.	6263413.	1759777.							
CONTRACT 1C0051*	TOTAL AMOUNT = $	39201000.00										
			13067000.	13067000.	13067000.							
CONTRACT 1C0151*	TOTAL AMOUNT = $	350000.00										
				350000.								
CONTRACT 1C0181	TOTAL AMOUNT = $	2931978.32										
				681571.	2047560.	202847.						
CONTRACT 1C1162*	TOTAL AMOUNT = $	110000.00										
					110000.							
CONTRACT 1C3061	TOTAL AMOUNT = $	1028730.19										
						93134.	737758.	120772.	27066.			
CONTRACT 1C3071	TOTAL AMOUNT = $	1172673.00										
						573636.	514266.	79771.				
CONTRACT 1C3161	TOTAL AMOUNT = $	511207.54										
		245214.	265994.									
CONTRACT 1C3152	TOTAL AMOUNT = $	25612.00										
25612.												
CONTRACT 1C3011	TOTAL AMOUNT = $	1323781.68										
						276602.	905413.	114510.	27178.			
CONTRACT 1C1011	TOTAL AMOUNT = $	4729021.37										
					192004.	944464.	1165640.	916298.	237418.	1273197.		
CONTRACT 2C0065	TOTAL AMOUNT = $	30792.30										
			30792.									

Source: McDonald & Grefe, Inc.

Table B-2 (continued)

TOTAL CAPITAL EXPENDITURES : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1C0081	TOTAL AMOUNT = $	4773933.64											
							2901159.	1441215.	430560.	1000.			
CONTRACT 1C0161	TOTAL AMOUNT = $	1748477.57											
	1333043.	300430.											
CONTRACT 1C1161	TOTAL AMOUNT = $	994647.00											
	775147.	111504.							107896.				
CONTRACT 1C2051	TOTAL AMOUNT = $	1524789.48											
							221385.	977264.	142275.	178687.	5176.		
CONTRACT 1C2082	TOTAL AMOUNT = $	1471822.04											
						44764.	995473.	357205.	74381.				
CONTRACT 1C3172*	TOTAL AMOUNT = $	140000.00											
									140000.				
CONTRACT 1KC012*	TOTAL AMOUNT = $	50000.00											
						50000.							
CONTRACT 1KC017*	TOTAL AMOUNT = $	540000.00											
				540000.									
CONTRACT 1KC016	TOTAL AMOUNT = $	23139762.84											
				6313011.	11001615.	1872694.	947443.	5000.					
CONTRACT 1K3014	TOTAL AMOUNT = $	2557230.87											
							1164329.	1165793.	185602.	36715.	793.		
CONTRACT 1K3013	TOTAL AMOUNT = $	2621580.69											
							1137460.	1230850.	211676.	41594.			
CONTRACT 1K3015	TOTAL AMOUNT = $	871269.60											
												596976.	274293.
CONTRACT 1K0021	TOTAL AMOUNT = $	2789016.35											
					2434363.	354654.							
CONTRACT 1KC071	TOTAL AMOUNT = $	6532760.77											
				1245009.	3435435.	1530720.	321597.						
CONTRACT 1KC073	TOTAL AMOUNT = $	3123083.00											
							1374921.	1552103.	196059.				
CONTRACT 1KC081	TOTAL AMOUNT = $	874920.01											
					19482.	685589.	141718.	28132.					
CONTRACT 1KC082*	TOTAL AMOUNT = $	520000.00											
						520000.							
CONTRACT 1KC085	TOTAL AMOUNT = $	241558.95											
										189280.	52279.		
CONTRACT 1K1011	TOTAL AMOUNT = $	2875361.46											
						324035.	670057.	787372.	1093898.				
CONTRACT 1K3021	TOTAL AMOUNT = $	1357392.94											
							509875.	766842.	80677.				
CONTRACT 1K3073	TOTAL AMOUNT = $	1420041.86											
							964166.	441776.	14100.				
CONTRACT 1K3074*	TOTAL AMOUNT = $	390000.00											
								390000.					
CONTRACT 1M0012	TOTAL AMOUNT = $	6373754.60											
					2755103.	2171542.	1435270.	11980.					

Source: McDonald & Grefe, Inc.

Table B-2 (continued)

CONTRACT AMOUNT PER YEAR

1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1M0013	TOTAL AMOUNT = $ 6004040.16											
				3183827.	1795388.	1019825.						
CONTRACT 1M0032	TOTAL AMOUNT = $ 230000.00											
					230000.							
CONTRACT 1MC074*	TOTAL AMOUNT = $ 110000.00											
						110000.						
CONTRACT 1MC055	TOTAL AMOUNT = $ 46431.89											
			28080.	18352.								
CONTRACT 1M3012	TOTAL AMOUNT = $ 1449082.59											
						421181.	922023.	105879.				
CONTRACT 1M3011	TOTAL AMOUNT = $ 1440893.50											
						356909.	929518.	154467.				
CONTRACT 1MC011	TOTAL AMOUNT = $ 12804662.70											
			2521498.	5680248.	4456342.	146575.						
CONTRACT 1MC043	TOTAL AMOUNT = $ 3567215.59											
					2609373.	898247.	59600.					
CONTRACT 1M0042	TOTAL AMOUNT = $ 4711947.85											
				2216562.	2257336.	238050.						
CONTRACT 1M0073	TOTAL AMOUNT = $ 323436.26											
						210030.	113407.					
CONTRACT 1MC071	TOTAL AMOUNT = $ 4148123.87											
							1277679.	1959209.	804994.	41742.	64500.	
CONTRACT 1M0061	TOTAL AMOUNT = $ 3068854.56											
					1391260.	1520793.	156802.					
CONTRACT 1M4071	TOTAL AMOUNT = $ 0.00											
CONTRACT 1MC051	TOTAL AMOUNT = $ 8855624.03											
					5436646.	2913535.	505443.					
CONTRACT 1M3072	TOTAL AMOUNT = $ 347977.74											
												347978.
CONTRACT 1M3051	TOTAL AMOUNT = $ 1325808.69											
						39822.	1074510.	211477.				
CONTRACT 1M3041	TOTAL AMOUNT = $ 1466501.25											
						58366.	984085.	424050.				
CONTRACT 1R0011*	TOTAL AMOUNT = $ 27390000.00											
			9130000.	9130000.	9130000.							
CONTRACT 1RC052*	TOTAL AMOUNT = $ 5733999.00											
			3246333.	3246333.	3246333.							
CONTRACT 1R0057*	TOTAL AMOUNT = $ 23436000.00											
					7812000.	7812000.	7812000.					
CONTRACT 1R0071	TOTAL AMOUNT = $ 1881257.00											
		119748.	1630730.	130778.								
CONTRACT 1R0050	TOTAL AMOUNT = $ 4678817.37											
						2663766.	1783040.	232012.				
CONTRACT 1RC054C	TOTAL AMOUNT = $ 3924020.62											
				333473.	2758213.	828053.	4282.					

Source: McDonald & Grefe, Inc.

Table B-2 (continued)

TOTAL CAPITAL EXPENDITURES : BY YEAR OF EXPENDITURE

		CONTRACT AMOUNT PER YEAR										
	1965	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1R0101	TOTAL AMOUNT = $	4255803.56											
CONTRACT 1R3053	TOTAL AMOUNT = $	1263699.83			442782.	2945326.	670780.	196916.					
CONTRACT 1R3050	TOTAL AMOUNT = $	1347411.66				579560.	617626.	66514.					
CONTRACT 1R3421	TOTAL AMOUNT = $	92130.49					439183.	831532.	53661.	23035.			
CONTRACT 1R3412	TOTAL AMOUNT = $	228047.61						75479.	16651.				
CONTRACT 1R3402	TOTAL AMOUNT = $	185368.36			211701.	16346.							
CONTRACT 1R1011	TOTAL AMOUNT = $	2824798.12					141491.	34539.	8838.				
CONTRACT 1R3082	TOTAL AMOUNT = $	1509741.15				640610.	1168567.	527007.	488614.				
CONTRACT 1R3081	TOTAL AMOUNT = $	1480862.76				758068.	602950.	131423.	16301.				
CONTRACT 1R0051	TOTAL AMOUNT = $	6128542.92				835492.	523284.	110292.	11734.				
CONTRACT 1R0091	TOTAL AMOUNT = $	3561343.10	289226.	2766977.	2649948.	417418.	4974.						
CONTRACT 1R3101*	TOTAL AMOUNT = $	2300000.00			617031.	2318437.	625876.						
CONTRACT 1R3052	TOTAL AMOUNT = $	2479754.76						2300000.					
CONTRACT 1R3011	TOTAL AMOUNT = $	1659955.67				732899.	1603457.	143399.					
CONTRACT 1R4051*	TOTAL AMOUNT = $	1700000.00			261070.	962954.	271832.		164100.				
CONTRACT 1S3011	TOTAL AMOUNT = $	3209129.68						1700000.					
CONTRACT 1S3012	TOTAL AMOUNT = $	3223663.29				370721.	2484954.	349144.	4311.				
CONTRACT 1S1011*	TOTAL AMOUNT = $	3140000.00				261151.	2265836.	683469.	13207.				
CONTRACT 1S3101	TOTAL AMOUNT = $	0.00						3140000.					
CONTRACT 1S0041*	TOTAL AMOUNT = $	8110000.00										8110000.	
CONTRACT 1S3051	TOTAL AMOUNT = $	14034807.64								3564895.	6465487.	3488733.	515692.
CONTRACT 1S3014	TOTAL AMOUNT = $	5240041.26						989242.	2281929.	1543431.	425439.		
CONTRACT 1S3013	TOTAL AMOUNT = $	888057.94						87925.	619825.	180308.			

Source: McDonald & Grefe, Inc.

Table B-2 (continued)

TOTAL CAPITAL EXPENDITURES : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1S0012	TOTAL AMOUNT = $ 14853188.53												
			1226822.	5806965.	4981617.	2829870.	7914.						
CONTRACT 1S3026	TOTAL AMOUNT = $ 1099982.51												
										260076.	639013.	199693.	1200.
CONTRACT 1S0022	TOTAL AMOUNT = $ 18037718.86												
				1756107.	12562230.	2142623.	1440837.			195922.			
CONTRACT 1S3022	TOTAL AMOUNT = $ 2408831.58												
								36911.	1245440.	1110002.	16480.		
CONTRACT 1S0024	TOTAL AMOUNT = $ 11033459.55												
								4389892.	4555992.	1517142.	570433.		
CONTRACT 1S0033	TOTAL AMOUNT = $ 11825555.72												
										3320754.	5560156.	2891141.	53505.
CONTRACT 1S0032	TOTAL AMOUNT = $ 9927111.10												
										3418314.	4559510.	1923184.	16104.
CONTRACT 1S0036	TOTAL AMOUNT = $ 1411690.23												
									1223322.	171374.	16994.		
CONTRACT 1S0031	TOTAL AMOUNT = $ 11994093.78												
								6067842.	4706578.	1219673.			
CONTRACT 1S3021	TOTAL AMOUNT = $ 3221709.30												
							233005.	1806632.	1182073.				
CONTRACT 1S3015	TOTAL AMOUNT = $ 2102261.73												
									1407733.	676660.	17369.	500.	
CONTRACT 1S1001	TOTAL AMOUNT = $ 5298392.25												
							424977.	1001268.	1777830.	400652.	47530.	1646134.	
CONTRACT 1T0012*	TOTAL AMOUNT = $ 330000.00												
			330000.										
CONTRACT 1T0013	TOTAL AMOUNT = $ 3141340.33												
						883345.	2038699.	219297.					
CONTRACT 1T0018	TOTAL AMOUNT = $ 2080885.29												
										946673.	1134213.		
CONTRACT 1T0019*	TOTAL AMOUNT = $ 40000.00												
								40000.					
CONTRACT 1T0020*	TOTAL AMOUNT = $ 40000.00												
			40000.										
CONTRACT 1T0061	TOTAL AMOUNT = $ 3126495.55												
				530950.	1412775.	822237.	360434.						
CONTRACT 1Z4562	TOTAL AMOUNT = $ 392890.41												
									62871.	330019.			
CONTRACT 1Z3152	TOTAL AMOUNT = $ 822373.37												
								275945.	499642.	56786.			
CONTRACT 1Z3150	TOTAL AMOUNT = $ 2245605.04												
							43605.	1835127.	278743.	88131.			
CONTRACT 1Z3171	TOTAL AMOUNT = $ 580174.64												
								112413.	412169.	55593.			
CONTRACT 1Z3170	TOTAL AMOUNT = $ 384761.50												
							153554.	210206.	21002.				

Source: McDonald & Grefe, Inc.

Table B-2 (continued)

TOTAL CAPITAL EXPENDITURES : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 123314	TOTAL AMOUNT = $	138344.00										
CONTRACT 129000	TOTAL AMOUNT = $	454992.63							118993.	19351.		
CONTRACT 129005	TOTAL AMOUNT = $	784368.32						324394.	130599.			
CONTRACT 129009	TOTAL AMOUNT = $	226038.93								231273.	53096.	
CONTRACT 123156	TOTAL AMOUNT = $	515638.89								157987.	68052.	
CONTRACT 123157	TOTAL AMOUNT = $	446774.78					71231.	424408.	15000.	5000.		
CONTRACT 221016	TOTAL AMOUNT = $	3191250.40					307441.	139333.				
CONTRACT 124533	TOTAL AMOUNT = $	576786.10									3066874.	124377.
CONTRACT 124060	TOTAL AMOUNT = $	439218.50				13675.	386792.	120748.	50572.			
CONTRACT 124503	TOTAL AMOUNT = $	972713.76									236759.	202460.
CONTRACT 124497	TOTAL AMOUNT = $	3199167.73							142940.	607136.	208401.	14236.
CONTRACT 121019	TOTAL AMOUNT = $	1382074.89						90000.	2631659.	477509.		
CONTRACT 122018	TOTAL AMOUNT = $	248736.79									1382075.	
CONTRACT 124495	TOTAL AMOUNT = $	1554740.10						82487.	120413.	45836.		
CONTRACT 129006	TOTAL AMOUNT = $	296579.74				388243.	1045182.	121315.				
CONTRACT 129004	TOTAL AMOUNT = $	249358.56							87404.	184046.	25131.	
CONTRACT 124561	TOTAL AMOUNT = $	302601.98							147605.	101754.		
CONTRACT 124493*	TOTAL AMOUNT = $	60000.00					126744.	175858.				
CONTRACT 123149*	TOTAL AMOUNT = $	250000.00										
CONTRACT 123151*	TOTAL AMOUNT = $	380000.00										
CONTRACT 123153*	TOTAL AMOUNT = $	840000.00										
CONTRACT 123155*	TOTAL AMOUNT = $	650000.00										
CONTRACT 123158*	TOTAL AMOUNT = $	620000.00										

		60000.										
	290000.											
				380000.								
					840000.							
			650000.									
				620000.								

Source: McDonald & Grefe, Inc.

Table B-2 (continued)

TOTAL CAPITAL EXPENDITURES : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 123159*	TOTAL AMOUNT = $	530000.00										
					530000.							
CONTRACT 124492*	TOTAL AMOUNT = $	200000.00										
						200000.						
CONTRACT 124491*	TOTAL AMOUNT = $	90000.00										
								90000.				
CONTRACT 124563*	TOTAL AMOUNT = $	130000.00										
					130000.							
CONTRACT 124505*	TOTAL AMOUNT = $	80000.00										
				80000.								
CONTRACT 124502*	TOTAL AMOUNT = $	400000.00										
								400000.				
CONTRACT 123310*	TOTAL AMOUNT = $	260000.00										
				260000.								
CONTRACT 124535*	TOTAL AMOUNT = $	80000.00										
								80000.				
CONTRACT 124570*	TOTAL AMOUNT = $	40000.00										
					40000.							
CONTRACT 180021	TOTAL AMOUNT = $	6233919.55										
			1556286.	4240933.	436701.							
CONTRACT 1C0011*	TOTAL AMOUNT = $	1785999.00										
			595333.	595333.	595333.							
CONTRACT 1C4161	TOTAL AMOUNT = $	1154696.11										
1083707.	70989.											
CONTRACT 1C0071	TOTAL AMOUNT = $	3637882.98										
				2371835.	1074989.	191060.						
CONTRACT 1C0171	TOTAL AMOUNT = $	2447628.22										
35753.	2240893.	169992.	35.									
CONTRACT 1C0043	TOTAL AMOUNT = $	1111514.10										
					1045111.	66403.						
CONTRACT 1K0061	TOTAL AMOUNT = $	15888560.02										
			188213.	6977895.	7463783.	1258669.						
CONTRACT 1K0013	TOTAL AMOUNT = $	4132102.19										
		582105.	2300384.	1148743.	100870.							
CONTRACT 1K0014	TOTAL AMOUNT = $	3203486.07										
		391037.	1403139.	5388968.	892242.	3100.					125000.	
CONTRACT 1K0015	TOTAL AMOUNT = $	16034009.58										
			5606694.	7136794.	2442607.	823451.	24464.					
CONTRACT 1K0051	TOTAL AMOUNT = $	4409404.08										
		1742432.	2432319.	214653.								
CONTRACT 1M0041	TOTAL AMOUNT = $	9651865.27										
				1442162.	5376040.	2833664.						
CONTRACT 1M0031	TOTAL AMOUNT = $	11574260.45										
				1544516.	9209604.	816759.	2617.	613.	150.			
CONTRACT 1K0053	TOTAL AMOUNT = $	7852155.98										
		52512.	3119675.	3777983.	887983.	1000.	13000.					

Source: McDonald & Grefe, Inc.

Table B-2 (continued)

TOTAL CAPITAL EXPENDITURES : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	195+	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1RC052	TOTAL AMOUNT = $	5899673.74											
			5164537.	735137.									
CONTRACT 1RC057C	TOTAL AMOUNT = $	3863469.76											
				966556.	2529904.	367010.							
CONTRACT 1RC058C	TOTAL AMOUNT = $	2537312.92											
				1215333.	906499.	415482.							
CONTRACT 1RC081	TOTAL AMOUNT = $	4817915.29											
		517673.	3777837.	512405.	10000.								
CONTRACT 1RC021	TOTAL AMOUNT = $	2284231.70											
		238427.	1867174.	178631.									
CONTRACT 1S0011	TOTAL AMOUNT = $	9267290.77											
			98897.	722343.	7459382.	986666.							
CONTRACT 1S0013	TOTAL AMOUNT = $	14423288.15											
			786846.	6627477.	4343778.	2165187.							
CONTRACT 1S0051A	TOTAL AMOUNT = $	22240817.66											
					6110063.	7517185.	5545094.	1826720.	1241755.				
CONTRACT 1S0023	TOTAL AMOUNT = $	20605430.45											
			1359660.	5723318.	4140699.	7292326.	2089427.						
CONTRACT 1S0021	TOTAL AMOUNT = $	10948196.18											
						9240665.	1707531.						
CONTRACT 1T0011	TOTAL AMOUNT = $	94007860.00											
		12582050.	25866715.	35258212.	18675596.	1624887.							
CONTRACT 1TC016	TOTAL AMOUNT = $	1002873.17											
				158664.	238743.	368946.	236520.						
CONTRACT 1TC017	TOTAL AMOUNT = $	2412951.60											
							455327.	1910045.	47579.				
CONTRACT 1Z4793	TOTAL AMOUNT = $	644476.49											
										563663.	37114.	43702.	
CONTRACT 1Z2014	TOTAL AMOUNT = $	2451001.58											
						559134.	1134667.	612579.	144627.				
CONTRACT 1Z2013	TOTAL AMOUNT = $	471804.54											
					58673.	114525.	117773.	180833.					
CONTRACT 1Z4482	TOTAL AMOUNT = $	9549309.83											
					327964.	4381734.	2315232.	773829.	1750551.				
CONTRACT 1Z4481	TOTAL AMOUNT = $	11530501.57											
				2000782.	5409824.	1905890.	2214006.						
CONTRACT 1Z4483	TOTAL AMOUNT = $	9516027.20											
						3271326.	5123609.	1121092.					
CONTRACT 1Z4481	TOTAL AMOUNT = $	5000.00											
								5000.					
CONTRACT 1Z2015+	TOTAL AMOUNT = $	590000.00											
					590000.								
CONTRACT 1Z4527+	TOTAL AMOUNT = $	220000.00											
								220000.					
CONTRACT 1Z4526+	TOTAL AMOUNT = $	50000.00											
							50000.						

Source: McDonald & Grefe, Inc.

Table B-2 (continued)

TOTAL CAPITAL EXPENDITURES : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964+	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 124061+	TOTAL AMOUNT = $	130000.00											
							130000.						
CONTRACT 122016	TOTAL AMOUNT = $	70000.00											
						70000.							
CONTRACT 224522+	TOTAL AMOUNT = $	130000.00											
								130000.					
CONTRACT 124520+	TOTAL AMOUNT = $	80000.00											
								80000.					
CONTRACT 224535	TOTAL AMOUNT = $	30000.00											
						30000.							
CONTRACT 224585+	TOTAL AMOUNT = $	120000.00											
								120000.					
CONTRACT 204163+	TOTAL AMOUNT = $	130000.00											
						130000.							
CONTRACT 224586+	TOTAL AMOUNT = $	40000.00											
						40000.							
CONTRACT 204151+	TOTAL AMOUNT = $	50000.00											
								50000.					
CONTRACT 124791	TOTAL AMOUNT = $	7754485.75											
				45000.		153000.		543436.	2636108.	1960328.	657337.	1799277.	
CONTRACT 224989	TOTAL AMOUNT = $	2571.23											
			2571.										
CONTRACT 220015	TOTAL AMOUNT = $	540866.79											
						113501.	275941.	139317.	8238.	3870.			
CONTRACT 221010	TOTAL AMOUNT = $	2404975.16											
						35497.	1308944.	805274.	237000.	9106.	9158.		
CONTRACT 150013	TOTAL AMOUNT = $	1730741.53											
								810704.	920038.				
CONTRACT 224487	TOTAL AMOUNT = $	2530338.26											
				338036.		1213813.	777902.	200538.					
CONTRACT 221014	TOTAL AMOUNT = $	8908112.12											
						1332721.	3109596.	3869362.	596433.				
CONTRACT 224316	TOTAL AMOUNT = $	27404537.31											
			2454364.	5083952.	9171228.	9260409.	1252181.	182404.					
CONTRACT 221014	TOTAL AMOUNT = $	73206.95											
										32022.	41185.		
CONTRACT 124487	TOTAL AMOUNT = $	6690429.03											
							2315646.	3006940.	466870.		900973.		
CONTRACT 224788	TOTAL AMOUNT = $	1278053.26											
												1278053.	
CONTRACT 122011	TOTAL AMOUNT = $	4354715.09											
				26019.	496047.	1337117.	2495533.						
CONTRACT 122012	TOTAL AMOUNT = $	1508516.76											
					152996.	229027.	250675.	532533.			343286.		
CONTRACT 224602	TOTAL AMOUNT = $	150269777.57											
						500000.	2539826.	7692563.	25374019.	29758082.	47964791.	36440496.	

Source: McDonald & Grefe, Inc.

Table B-2 (continued)

TOTAL CAPITAL EXPENDITURES : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1Z4552	TOTAL AMOUNT = $	172020.60											
												116410.	55611.
CONTRACT 1Z2011	TOTAL AMOUNT = $	28745412.48											
								2820430.	8964322.	10483879.	5406792.	1090639.	
CONTRACT 1Z4551	TOTAL AMOUNT = $	2539747.29											
				311020.	1058014.	220271.	320256.	66884.	215792.	180665.	166846.		
CONTRACT 1Z4552	TOTAL AMOUNT = $	2828161.72											
								1206043.	596880.	696602.	328637.		
CONTRACT 2Z1011	TOTAL AMOUNT = $	6548088.13											
						536257.	3773658.	1868051.	337482.	29097.	3543.		
CONTRACT ENGPBT*	TOTAL AMOUNT = $	53132000.00											
						11510000.	19082000.	9842000.	7644000.	3483000.	1566000.		
CONTRACT BONDEXP	TOTAL AMOUNT = $	943000.00											
			943000.										
CONTRACT ENCPTB*	TOTAL AMOUNT = $	73089000.00											
		34453000.	11500000.	12174000.	14962000.								
CONTRACT BRTGEN*	TOTAL AMOUNT = $	22303000.00											
		2109000.	1967000.	2252000.	2418000.	3082000.	3273000.	3261000.	3941000.				
CONTRACT BRTCON*	TOTAL AMOUNT = $	36355000.00											
			1004000.	1074000.	1385000.	1066000.	2131000.	4424000.	8646000.	14231000.	2394000.		
CONTRACT LANDAC*	TOTAL AMOUNT = $	94847000.00											
			9484700.										
CONTRACT AGENCYA	TOTAL AMOUNT = $	7918500.00											
						7918500.							

Source: McDonald & Grefe, Inc.

Table B-3

TOTAL REGIONAL CONTRACTS : AMOUNTS BY YEAR

	TOTAL CONTRACT AMOUNTS AND PERCENT		
1964	$	1404755.43	.12 PCT.
1965	$	10044037.60	.86 PCT.
1966	$	48195585.84	4.14 PCT.
1967	$	128687060.04	11.05 PCT.
1968	$	225969060.57	19.41 PCT.
1969	$	197929942.52	17.00 PCT.
1970	$	135349914.97	11.63 PCT.
1971	$	112943342.98	9.70 PCT.
1972	$	80898628.33	6.95 PCT.
1973	$	72289873.79	6.21 PCT.
1974	$	81528873.96	7.00 PCT.
1975	$	67274135.39	5.78 PCT.
1976	$	1605455.09	.14 PCT.
TOTAL	$	1164120666.51	100.00 PCT.

Source: McDonald & Grefe, Inc.

Table B-4

TOTAL REGIONAL CONTRACTS : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1A0011	TOTAL AMOUNT = $ 4785193.57												
			88943.	2251305.	2150369.	250571.	44005.						
CONTRACT 1A0021	TOTAL AMOUNT = $ 5566253.30												
			28166.	1871337.	336[illegible]592.	295150.	31[illegible]9.						
CONTRACT 1A0023	TOTAL AMOUNT = $ 58079.89												
												58080.	
CONTRACT 1A0031	TOTAL AMOUNT = $ 4255426.55												
			22403.	1684244.	2313364.	214050.	21365.						
CONTRACT 1A0041	TOTAL AMOUNT = $ 6466241.60												
			1235815.	3739403.	113 187.	357809.	3028.						
CONTRACT 1A0042	TOTAL AMOUNT = $ 2454757.45												
			93803.	2085207.	147712.	128036.							
CONTRACT 1A0051	TOTAL AMOUNT = $ 5576507.64												
			41069.	2446296.	2416585.	572300.	100258.						
CONTRACT 1A0052	TOTAL AMOUNT = $ 661984.80												
				100684.	511600.	49702.							
CONTRACT 1A0061	TOTAL AMOUNT = $ 461017.00												
			150656.	310362.									
CONTRACT 1A0063*	TOTAL AMOUNT = $ 10769001.00												
				3589667.	3589667.	3589667.							
CONTRACT 1A0064	TOTAL AMOUNT = $ 1144164.86												
				71434.	1001480.	71251.							
CONTRACT 1A0071	TOTAL AMOUNT = $ 1686991.79												
				76308.	1238774.	291909.	80000.						
CONTRACT 1A0072	TOTAL AMOUNT = $ 2629979.84												
					682964.	1284891.	434101.	128024.		100000.			
CONTRACT 1A0074	TOTAL AMOUNT = $ 161045.54												
										144572.	15973.	500.	
CONTRACT 1A0077	TOTAL AMOUNT = $ 4894217.81												
											2710383.	2183834.	
CONTRACT 1A0081	TOTAL AMOUNT = $ 3078572.44												
						698000.	2185635.	184585.	10353.				
CONTRACT 1A0091	TOTAL AMOUNT = $ 1789726.92												
						398671.	1190593.	195713.	3500.	1250.			
CONTRACT 1A0092	TOTAL AMOUNT = $ 1397139.80												
					540289.	792410.	64440.						
CONTRACT 1A3091	TOTAL AMOUNT = $ 1233428.08												
							674871.	484586.	73972.				
CONTRACT 1A3424	TOTAL AMOUNT = $ 120537.59												
									102048.	18489.			
CONTRACT 1A3421	TOTAL AMOUNT = $ 98067.96												
							76855.	21213.					
CONTRACT 1A1021	TOTAL AMOUNT = $ 1030582.26												
							430664.	394097.	205821.				
CONTRACT 1A1011	TOTAL AMOUNT = $ 4539370.92												
					523135.	2280889.	1036997.	698350.					

Source: McDonald & Grefe, Inc.

Table B-4 (continued)

TOTAL REGIONAL CONTRACTS : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1A3051	TOTAL AMOUNT = $			1281721.40									
					196141.	604491.	404978.	76112.					
CONTRACT 1A3011	TOTAL AMOUNT = $			1145529.37									
					175966.	714134.	196536.	58893.					
CONTRACT 1A3021	TOTAL AMOUNT = $			1207183.18									
					249480.	645363.	214276.	96867.	1500.				
CONTRACT 1A3161	TOTAL AMOUNT = $			1754102.96									
					314433.	597269.	35973.	106428.					
CONTRACT 1A3241	TOTAL AMOUNT = $			1015161.41									
					408573.	492613.	20596.	80660.	12719.				
CONTRACT 1A3242	TOTAL AMOUNT = $			1188854.68									
					376588.	612573.	38366.	69332.					
CONTRACT 1A3181*	TOTAL AMOUNT = $			1240000.00									
				1240000.									
CONTRACT 1B0031	TOTAL AMOUNT = $			15235574.44									
					4993455.	9065566.	926054.				250000.		
CONTRACT 1B0033	TOTAL AMOUNT = $			1400674.22									
				719423.	522218.	84236.	75000.						
CONTRACT 1B0041	TOTAL AMOUNT = $			2571956.73									
				870512.	1542344.	159101.							
CONTRACT 1C0021*	TOTAL AMOUNT = $			30597999.00									
				10199333.	10199333.	10199333.							
CONTRACT 1C0041	TOTAL AMOUNT = $			31625432.35									
		512650.	1264747.	5826273.	6263412.	1759777.							
CONTRACT 1C0051*	TOTAL AMOUNT = $			39201000.00									
					13067000.	13067000.	13067000.						
CONTRACT 1C0151*	TOTAL AMOUNT = $			3500000.00									
						350000.							
CONTRACT 1C0181	TOTAL AMOUNT = $			2931978.32									
						681571.	2047560.	202847.					
CONTRACT 1C1162*	TOTAL AMOUNT = $			1100000.00									
							110000.						
CONTRACT 1C3161	TOTAL AMOUNT = $			1028730.19									
							93134.	787758.	120772.	27066.			
CONTRACT 1C3171	TOTAL AMOUNT = $			1172673.00									
							578636.	514266.	79771.				
CONTRACT 1C3161	TOTAL AMOUNT = $			511207.94									
			245214.	265994.									
CONTRACT 1C3152	TOTAL AMOUNT = $			25612.00									
		25612.											
CONTRACT 1C3211	TOTAL AMOUNT = $			1323781.68									
							276682.	935413.	114510.	27178.			
CONTRACT 1C1911	TOTAL AMOUNT = $			4729021.37									
						192004.	944464.	1165640.	916298.	237418.	1273197.		
CONTRACT 2C0065	TOTAL AMOUNT = $			30792.30									
					30792.								

Source: McDonald & Grefe, Inc.

Table B-4 (continued)

TOTAL REGIONAL CONTRACTS : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1C0081 TOTAL AMOUNT = $				4773933.84									
								2931159.	1441215.	430560.	1000.		
CONTRACT 1C0161 TOTAL AMOUNT = $				1748477.57									
	1368048.	380430.											
CONTRACT 1C1161 TOTAL AMOUNT = $				994647.00									
		775147.	111604.						107896.				
CONTRACT 1C3051 TOTAL AMOUNT = $				1524789.48									
							221385.	977266.	142275.	178687.	5176.		
CONTRACT 1C3082 TOTAL AMOUNT = $				1471822.04									
						44764.	995473.	357205.	74381.				
CONTRACT 1C3172* TOTAL AMOUNT = $				140000.00									
									140000.				
CONTRACT 1K0012* TOTAL AMOUNT = $				50000.00									
						50000.							
CONTRACT 1K0017* TOTAL AMOUNT = $				540000.00									
				540000.									
CONTRACT 1K0016 TOTAL AMOUNT = $				20139762.84									
				6313011.	11001615.	1872694.	947443.	5000.					
CONTRACT 1K3014 TOTAL AMOUNT = $				2557230.87									
							1168329.	1165793.	185602.	36715.	793.		
CONTRACT 1K3013 TOTAL AMOUNT = $				2621580.69									
							1137460.	1230850.	211676.	41594.			
CONTRACT 1K3015 TOTAL AMOUNT = $				871269.60									
												596976.	274293.
CONTRACT 1K0021 TOTAL AMOUNT = $				2789016.35									
					2434363.	354654.							
CONTRACT 1K0071 TOTAL AMOUNT = $				6532760.77									
				1245009.	3435435.	1530720.	321597.						
CONTRACT 1K0073 TOTAL AMOUNT = $				3123083.00									
							1374921.	1552103.	196059.				
CONTRACT 1K0081 TOTAL AMOUNT = $				874920.01									
					19482.	685589.	141718.	28132.					
CONTRACT 1K0082* TOTAL AMOUNT = $				520000.00									
						520000.							
CONTRACT 1K0085 TOTAL AMOUNT = $				241558.95									
										189280.	52279.		
CONTRACT 1K1011 TOTAL AMOUNT = $				2875361.46									
						324035.	670057.	787372.	1093898.				
CONTRACT 1K3021 TOTAL AMOUNT = $				1357392.94									
							509875.	766842.	80677.				
CONTRACT 1K3073 TOTAL AMOUNT = $				1420041.86									
							964166.	441776.	14100.				
CONTRACT 1K3074* TOTAL AMOUNT = $				390000.00									
								390000.					
CONTRACT 1M0012 TOTAL AMOUNT = $				6373794.60									
					2755103.	2171542.	1435270.	11880.					

Source: McDonald & Grefe, Inc.

Table B-4 (continued)

TOTAL REGIONAL CONTRACTS : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1M0013 TOTAL AMOUNT = $				6004940.16									
					3188827.	1795388.	1019825.						
CONTRACT 1M0032 TOTAL AMOUNT = $				230000.00									
						230000.							
CONTRACT 1M0074* TOTAL AMOUNT = $				11[illegible]									
							110000.						
CONTRACT 1M0055 TOTAL AMOUNT = $				46431.89									
				28080.	18352.								
CONTRACT 1M3012 TOTAL AMOUNT = $				1449082.59									
							421181.	922023.	105879.				
CONTRACT 1M3011 TOTAL AMOUNT = $				1440893.90									
							356909.	929518.	154467.				
CONTRACT 1M0011 TOTAL AMOUNT = $				12804662.70									
				2521498.	5680248.	4456342.	146575.						
CONTRACT 1M0043 TOTAL AMOUNT = $				3567219.99									
						2609373.	898247.	59600.					
CONTRACT 1M0042 TOTAL AMOUNT = $				4711947.85									
					2216562.	2257336.	238050.						
CONTRACT 1M0073 TOTAL AMOUNT = $				323436.26									
							210030.	113407.					
CONTRACT 1M0071 TOTAL AMOUNT = $				4148123.87									
								1277679.	1959209.	804994.	41742.	64500.	
CONTRACT 1M0061 TOTAL AMOUNT = $				3068854.56									
						1391260.	1520793.	156802.					
CONTRACT 1M4071 TOTAL AMOUNT = $					[illegible]								
CONTRACT 1M0051 TOTAL AMOUNT = $				8855624.03									
						5436646.	2913535.	505443.					
CONTRACT 1M3072 TOTAL AMOUNT = $				347977.74									
													347978.
CONTRACT 1M3051 TOTAL AMOUNT = $				1325808.69									
							39822.	1074510.	211477.				
CONTRACT 1M3041 TOTAL AMOUNT = $				1466501.25									
							58366.	984085.	424050.				
CONTRACT 1R0011* TOTAL AMOUNT = $				27390000.00									
			9130000.	9130000.	9130000.								
CONTRACT 1R0052* TOTAL AMOUNT = $				9738999.00									
			3246333.	3246333.	3246333.								
CONTRACT 1R0057* TOTAL AMOUNT = $				23436000.00									
						7812000.	7812000.	7812000.					
CONTRACT 1R0071 TOTAL AMOUNT = $				1881257.00									
		119748.	1630730.	130778.									
CONTRACT 1R0050 TOTAL AMOUNT = $				4678817.37									
							2663766.	1783040.	232012.				
CONTRACT 1R0054C TOTAL AMOUNT = $				3924020.62									
					333473.	2758213.	828053.	4282.					

Source: McDonald & Grefe, Inc.

Table B-4 (continued)

TOTAL REGIONAL CONTRACTS : BY YEAR OF EXPENDITURE

		CONTRACT AMOUNT PER YEAR											
1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1R[illegible]	TOTAL AMOUNT = $		42558 3.56									
CONTRACT 1R3[illegible]58	TOTAL AMOUNT = $		1262699.83		442782.	2945326.	670780.	196916.				
CONTRACT 1R3[illegible]50	TOTAL AMOUNT = $		1247411.66			575560.	617626.	66514.				
CONTRACT 1R3421	TOTAL AMOUNT = $		92130.49				439183.	831532.	53661.	23[illegible]35.		
CONTRACT 1R3412	TOTAL AMOUNT = $		228 47.61					75479.	16651.			
CONTRACT 1R3[illegible]2	TOTAL AMOUNT = $		185268.36		211701.	16346.						
CONTRACT 1R1011	TOTAL AMOUNT = $		2824798.12				141991.	34539.	8838.			
CONTRACT 1R3[illegible]82	TOTAL AMOUNT = $		1529741.15			640610.	1168567.	527007.	488614.			
CONTRACT 1R[illegible]81	TOTAL AMOUNT = $		1483862.76			758068.	603950.	131423.	16201.			
CONTRACT 1RC051	TOTAL AMOUNT = $		6128542.92			835492.	523284.	110292.	11794.			
CONTRACT 1R[illegible]91	TOTAL AMOUNT = $	289226.	2766977.	2649548.	417418.	4974.						
CONTRACT 1R31.1*	TOTAL AMOUNT = $		3501343.11	617031.	2318437.	625876.						
CONTRACT 1R2052	TOTAL AMOUNT = $		2479754.76				2300000.					
CONTRACT 1R3 11	TOTAL AMOUNT = $		1659955.67			732899.	1603457.	143399.				
CONTRACT 1R4 51*	TOTAL AMOUNT = $			261072.	962954.	271832.		164100.				
CONTRACT 1S3011	TOTAL AMOUNT = $		3209129.68				170000.					
CONTRACT 1S3012	TOTAL AMOUNT = $		3223663.29			371721.	2484954.	349144.	4311.			
CONTRACT 1S1011*	TOTAL AMOUNT = $		314[illegible]			261151.	2265836.	683469.	13267.			
CONTRACT 1S31.1	TOTAL AMOUNT = $		0.00				3140000.					
CONTRACT 1S0041*	TOTAL AMOUNT = $		8110000.00								8110000.	
CONTRACT 1S3051	TOTAL AMOUNT = $		14034807.64						3564895.	6465487.	3488733.	515692.
CONTRACT 1S3,14	TOTAL AMOUNT = $		5243041.26				989242.	2281929.	1543451.	425439.		
CONTRACT 1S3013	TOTAL AMOUNT = $		886057.94				87925.	619825.	180308.			

Source: McDonald & Grefe, Inc.

Table B-4 (continued)

TOTAL REGIONAL CONTRACTS : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

		1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1S0012	TOTAL AMOUNT = $	14853188.93												
				1226822.	5836965.	4981617.	2829871.	7914.						
CONTRACT 1S3026	TOTAL AMOUNT = $	1099982.51												
											260076.	639013.	199693.	1200.
CONTRACT 1S0022	TOTAL AMOUNT = $	18097718.86												
				1756177.	12562230.	2142623.	1440937.				195922.			
CONTRACT 1S3022	TOTAL AMOUNT = $	2408831.58												
									36911.	1245440.	1110002.	16482.		
CONTRACT 1S0024	TOTAL AMOUNT = $	11033459.55												
									4389892.	4555992.	1517142.	570433.		
CONTRACT 1S0033	TOTAL AMOUNT = $	11825555.72												
											3320754.	5562156.	2891141.	53505.
CONTRACT 1S0032	TOTAL AMOUNT = $	9927111.10												
											3418314.	4559510.	1933184.	16104.
CONTRACT 1S0036	TOTAL AMOUNT = $	1411693.23												
										1223322.	171374.	16994.		
CONTRACT 1S0031	TOTAL AMOUNT = $	11594093.78												
									6367842.	4706578.	1219673.			
CONTRACT 1S3021	TOTAL AMOUNT = $	3221709.30												
								2330.5.	1836632.	1182073.				
CONTRACT 1S3015	TOTAL AMOUNT = $	2172261.73												
										1407753.	676660.	17369.	500.	
CONTRACT 1S1001	TOTAL AMOUNT = $	5298392.25												
								424977.	1001268.	1777830.	400652.	47530.	1646134.	
CONTRACT 1T0012*	TOTAL AMOUNT = $	3300000.00												
				3300000.										
CONTRACT 1T0013	TOTAL AMOUNT = $	3141340.33												
						883345.	2038699.	219297.						
CONTRACT 1T0018	TOTAL AMOUNT = $	2080885.29												
											946673.	1134213.		
CONTRACT 1T0019*	TOTAL AMOUNT = $	4000000.00												
									40000.					
CONTRACT 1T0020*	TOTAL AMOUNT = $	4000000.00												
				4000000.										
CONTRACT 1T0061	TOTAL AMOUNT = $	3126495.55												
				530950.	1412775.	822337.	360434.							
CONTRACT 1Z4562	TOTAL AMOUNT = $	392897.41												
										62871.	330019.			
CONTRACT 1Z3152	TOTAL AMOUNT = $	822373.37												
									275945.	489642.	56786.			
CONTRACT 1Z3150	TOTAL AMOUNT = $	2245605.04												
								436 5.	1835127.	278743.	88131.			
CONTRACT 1Z3171	TOTAL AMOUNT = $	580174.64												
									112413.	412169.	55593.			
CONTRACT 1Z3170	TOTAL AMOUNT = $	384761.99												
								153554.	210206.	21002.				

Source: McDonald & Grefe, Inc.

Table B-4 (continued)

TOTAL REGIONAL CONTRACTS : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1Z3314	TOTAL AMOUNT = $	138344.00											
CONTRACT 1Z4000	TOTAL AMOUNT = $	454992.63								118993.	19351.		
CONTRACT 1Z9[illegible]5	TOTAL AMOUNT = $	284368.32							324394.	133599.			
CONTRACT 1Z9[illegible]9	TOTAL AMOUNT = $	226038.93									231273.	53096.	
CONTRACT 1Z3156	TOTAL AMOUNT = $	515638.89									157987.	68052.	
CONTRACT 1Z3157	TOTAL AMOUNT = $	446774.78						71231.	424438.	15[illegible].	5[illegible].		
CONTRACT 2Z1[illegible]16	TOTAL AMOUNT = $	3191250.43						307441.	139333.				
CONTRACT 1Z4533	TOTAL AMOUNT = $	5767[illegible].14										3066874.	124377.
CONTRACT 1Z4[illegible]63	TOTAL AMOUNT = $	439218.90					18675.	386792.	128748.	53572.			
CONTRACT 1Z45[illegible]3	TOTAL AMOUNT = $	972713.76										236759.	202460.
CONTRACT 1Z4497	TOTAL AMOUNT = $	2199167.73								142940.	607136.	208401.	14236.
CONTRACT 1Z1[illegible]19	TOTAL AMOUNT = $	1382,74.89							9[illegible].	2631659.	477509.		
CONTRACT 1Z[illegible]18	TOTAL AMOUNT = $	248736.79										1382075.	
CONTRACT 1Z4485	TOTAL AMOUNT = $	1554740.10							82487.	120413.	45836.		
CONTRACT 1Z9[illegible]6	TOTAL AMOUNT = $	296579.74					388243.	1145182.	121315.				
CONTRACT 1Z9[illegible]4	TOTAL AMOUNT = $	249358.96								87404.	184946.	25131.	
CONTRACT 1Z4561	TOTAL AMOUNT = $	302601.58								147605.	101754.		
CONTRACT 1Z4493*	TOTAL AMOUNT = $	60000.00						126744.	175858.				
CONTRACT 1Z3149*	TOTAL AMOUNT = $	290000.00	60000.										
CONTRACT 1Z3151*	TOTAL AMOUNT = $	380000.00				380000.							
CONTRACT 1Z3153*	TOTAL AMOUNT = $	840000.00			840000.								
CONTRACT 1Z3155*	TOTAL AMOUNT = $	650000.00		650000.									
CONTRACT 1Z3158*	TOTAL AMOUNT = $	620000.00			620000.								

Source: McDonald & Grefe, Inc.

Table B-4 (continued)

TOTAL REGIONAL CONTRACTS : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1Z3159*	TOTAL AMOUNT = $			530000.00									
CONTRACT 1Z4492*	TOTAL AMOUNT = $			2[illegible]		53[illegible].							
CONTRACT 1Z4451*	TOTAL AMOUNT = $			9[illegible]			200000.						
CONTRACT 1Z4563*	TOTAL AMOUNT = $			130000.00					9000.				
CONTRACT 1Z45[illegible]5*	TOTAL AMOUNT = $			8[illegible]		13[illegible]00.							
				80000.									
CONTRACT 1Z45[illegible]2*	TOTAL AMOUNT = $			4[illegible]					400000.				
CONTRACT 1Z331[illegible]*	TOTAL AMOUNT = $			26[illegible]									
				26[illegible]									
CONTRACT 1Z4535*	TOTAL AMOUNT = $			80000.00					80000.				
CONTRACT 1Z457 *	TOTAL AMOUNT = $			4[illegible]		40000.							
CONTRACT 1B0021	TOTAL AMOUNT = $			6233519.55									
			1556286.	424933.	436701.								
CONTRACT 1C0011*	TOTAL AMOUNT = $			1785999.00									
			595333.	595333.	595333.								
CONTRACT 1C4161	TOTAL AMOUNT = $			1154696.11									
		1083707.	70989.										
CONTRACT 1C[illegible]71	TOTAL AMOUNT = $			3637862.98									
				2371835.	1074989.	191060.							
CONTRACT 1C0171	TOTAL AMOUNT = $			2447628.22									
	36788.	2240893.	169992.	35.									
CONTRACT 1C[illegible]43	TOTAL AMOUNT = $			1111514.10									
					1045111.	66403.							
CONTRACT 1K[illegible]61	TOTAL AMOUNT = $			15888560.32									
			188213.	6977895.	7463783.	1258669.							
CONTRACT 1K[illegible]13	TOTAL AMOUNT = $			4132[illegible]2.19									
			582[illegible]5.	23[illegible]384.	1148743.	10[illegible]873.							
CONTRACT 1K0014	TOTAL AMOUNT = $			8203486.07									
			391037.	1403139.	5388968.	892242.	3133.					125000.	
CONTRACT 1K[illegible]15	TOTAL AMOUNT = $			16[illegible]34[illegible]9.58									
			5606694.	7136794.	2442607.	823451.	24464.						
CONTRACT 1K0051	TOTAL AMOUNT = $			44[illegible]9404.38									
			1742432.	2452319.	214653.								
CONTRACT 1M0041	TOTAL AMOUNT = $			9651865.37									
				1442162.	5376340.	2833664.							
CONTRACT 1M[illegible]31	TOTAL AMOUNT = $			11574260.45									
				1544516.	9209604.	816759.	2617.	613.	150.				
CONTRACT 1R0053	TOTAL AMOUNT = $			7852155.98									
			52512.	3119679.	3777983.	887983.	1000.	13000.					

Source: McDonald & Grefe, Inc.

Table B-4 (continued)

TOTAL REGIONAL CONTRACTS : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 180052	TOTAL AMOUNT = $ 5899673.74												
				5164537.	735137.								
CONTRACT 181570	TOTAL AMOUNT = $ 3863469.76												
					966556.	2529904.	367010.						
CONTRACT 180958	TOTAL AMOUNT = $ 2537212.92												
					1215333.	906499.	415482.						
CONTRACT 180081	TOTAL AMOUNT = $ 4817515.29												
			517673.	3777837.	512405.	10000.							
CONTRACT 180021	TOTAL AMOUNT = $ 2284231.70												
			238427.	1667174.	178631.								
CONTRACT 150211	TOTAL AMOUNT = $ 9267290.77												
			98899.	722343.	7459382.	986666.							
CONTRACT 150013	TOTAL AMOUNT = $ 14423288.15												
			786846.	6627477.	4843778.	2165187.							
CONTRACT 150051A	TOTAL AMOUNT = $ 22240817.66												
					6113063.	7517185.	5545194.	1826720.	1241755.				
CONTRACT 150023	TOTAL AMOUNT = $ 20605430.45												
			1359660.	5723318.	4140699.	7292326.	2089427.						
CONTRACT 150021	TOTAL AMOUNT = $ 18548196.18												
						9240665.	1707531.						
CONTRACT 170011	TOTAL AMOUNT = $ 94007860.00												
			12582052.	25866715.	35258212.	18675996.	1624887.						
CONTRACT 170016	TOTAL AMOUNT = $ 1092673.17												
					158664.	238743.	368946.	236520.					
CONTRACT 170017	TOTAL AMOUNT = $ 2412951.60												
								455327.	1910045.	47579.			
CONTRACT 124753	TOTAL AMOUNT = $ 644478.49												
										563663.	37114.	43702.	
CONTRACT 122014	TOTAL AMOUNT = $ 2451001.58												
							559134.	1134662.	612579.	144627.			
CONTRACT 122013	TOTAL AMOUNT = $ 471804.54												
						58673.	114525.	117773.	180833.				
CONTRACT 124482	TOTAL AMOUNT = $ 9549309.83												
						327964.	4381734.	2315232.	773829.	1750551.			
CONTRACT 124481	TOTAL AMOUNT = $ 11530501.57												
					2000782.	5409824.	1958900.	2214006.					
CONTRACT 224786	TOTAL AMOUNT = $ 1278053.26												
												1278053.	
CONTRACT 124483	TOTAL AMOUNT = $ 9516027.20												
							3271326.	5123609.	1121092.				
CONTRACT 124481	TOTAL AMOUNT = $ 5000.00												
									5000.				
CONTRACT 124751	TOTAL AMOUNT = $ 7754485.75												
					45000.	153009.		543436.	2636108.	1960328.	657337.	1799277.	
CONTRACT 224989	TOTAL AMOUNT = $ 2571.23												
			2571.										

Source: McDonald & Grefe, Inc.

Table B-4 (continued)

TOTAL REGIONAL CONTRACTS : BY YEAR OF EXPENDITURE

		CONTRACT AMOUNT PER YEAR											
	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 2Z[illegible]15	TOTAL AMOUNT = $	54 866.79											
						113[illegible]1.	275941.	139317.	8238.	3870.			
CONTRACT 2Z101[illegible]	TOTAL AMOUNT = $	24[illegible]979.16											
						35497.	13[illegible]8944.	8[illegible]5274.	237[illegible].	91[illegible]6.	9158.		
CONTRACT 1S[illegible] 13	TOTAL AMOUNT = $	173[illegible]741.53											
								81[illegible]704.	920038.				
CONTRACT 2Z4467	TOTAL AMOUNT = $	253[illegible]338.26											
				330036.	1213813.	777902.	200588.						
CONTRACT 2Z1014	TOTAL AMOUNT = $	89[illegible]1319.17											
					1332721.	31[illegible]9596.	3869362.	596433.	32[illegible]22.	41185.			
CONTRACT 2Z4316	TOTAL AMOUNT = $	27404537.31											
		2454364.	5[illegible]83952.	9171228.	926[illegible]09.	1252181.	182474.						
CONTRACT 1Z4487	TOTAL AMOUNT = $	669[illegible]429.[illegible]3											
						2315646.	3[illegible]06943.	466871.			9[illegible]0973.		
CONTRACT 1Z4551	TOTAL AMOUNT = $	2539747.29											
				311[illegible]2..	1[illegible]58014.	22[illegible]271.	32[illegible]256.	66884.	215792.	180665.		166846.	
CONTRACT 1Z4552	TOTAL AMOUNT = $	28281[illegible]1.72											
							1206343.	596880.	696602.	328637.			
CONTRACT 1Z2[illegible]15+	TOTAL AMOUNT = $	59[illegible]											
					59[illegible]0.								
CONTRACT 1Z4527+	TOTAL AMOUNT = $	22[illegible]											
									220000.				
CONTRACT 1Z4526+	TOTAL AMOUNT = $	5[illegible]											
								50[illegible]0.					
CONTRACT 1Z4 61+	TOTAL AMOUNT = $	130000.00											
							13[illegible].						
CONTRACT 1Z2 16	TOTAL AMOUNT = $	7[illegible]											
					70000.								
CONTRACT 2Z4522+	TOTAL AMOUNT = $	13[illegible]											
								13[illegible].					
CONTRACT 1Z4520+	TOTAL AMOUNT = $	80000.00											
								80[illegible].					
CONTRACT 2Z4535	TOTAL AMOUNT = $	3[illegible]											
					30000.								
CONTRACT 2Z4585+	TOTAL AMOUNT = $	12[illegible]											
								12[illegible].					
CONTRACT 2C4163+	TOTAL AMOUNT = $	130000.00											
					13[illegible].								
CONTRACT 2Z4586+	TOTAL AMOUNT = $	4[illegible]											
					4[illegible].								
CONTRACT 2C4151+	TOTAL AMOUNT = $	5[illegible]											
								50000.					
CONTRACT 1Z2[illegible]11	TOTAL AMOUNT = $	4354715.09											
			26[illegible]19.	496[illegible]47.	1337117.	2495533.							
CONTRACT 1Z2[illegible]12	TOTAL AMOUNT = $	1508516.76											
				152996.	229[illegible]27.	250675.	532533.				343286.		

Source: McDonald & Grefe, Inc.

Table B-4 (continued)

TOTAL REGIONAL CONTRACTS : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 2246 2	TOTAL AMOUNT = $	15[illegible]269777.57											
CONTRACT 124552	TOTAL AMOUNT = $	172[illegible].60				500000.	2539826.	7692563.	25374019.	29758082.	47964791.	36445496.	
CONTRACT 122011	TOTAL AMOUNT = $	28745412.46										116410.	55611.
CONTRACT 221011	TOTAL AMOUNT = $	6548 88.13						28[illegible]430.	8964322.	1[illegible]483879.	54[illegible]392.	1193689.	
						536257.	3773658.	1868[illegible]51.	337482.	29297.	3543.		

Source: McDonald & Grefe, Inc.

Table B-5

REGIONAL CONSTRUCTION CONTRACTS : AMOUNTS BY YEAR

TOTAL CONTRACT AMOUNTS AND PERCENT

1964	$	1368047.53	.23 PCT.
1965	$	6719437.76	1.15 PCT.
1966	$	29391432.65	5.04 PCT.
1967	$	67433342.64	11.56 PCT.
1968	$	126516062.15	21.68 PCT.
1969	$	101063799.06	17.32 PCT.
1970	$	70694673.65	12.11 PCT.
1971	$	67556178.00	11.58 PCT.
1972	$	34043642.54	5.83 PCT.
1973	$	25352771.08	4.34 PCT.
1974	$	25656092.95	4.40 PCT.
1975	$	26213662.79	4.49 PCT.
1976	$	1549844.38	.27 PCT.
TOTAL	$	583558987.18	100.00 PCT.

Source: McDonald & Grefe, Inc.

Table B-6

REGIONAL CONSTRUCTION CONTRACTS : BY YEAR OF EXPENDITURE

		CONTRACT AMOUNT PER YEAR											
	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1A0011	TOTAL AMOUNT = $				4785193.57								
			88343.	2251305.	2150369.	250571.	44005.						
CONTRACT 1A0021	TOTAL AMOUNT = $				5586253.30								
			23166.	1871337.	3360592.	295150.	31009.						
CONTRACT 1A0023	TOTAL AMOUNT = $				58079.69								
												58089.	
CONTRACT 1A0031	TOTAL AMOUNT = $				4255420.55								
			22403.	1684244.	2313364.	214050.	21365.						
CONTRACT 1A0041	TOTAL AMOUNT = $				6466241.60								
		1235815.	3739403.	1139187.	357809.	3028.							
CONTRACT 1A0042	TOTAL AMOUNT = $				2454757.45								
			93803.	2085207.	147712.	128036.							
CONTRACT 1A0051	TOTAL AMOUNT = $				5576507.64								
			41069.	2446296.	2416585.	572300.	100256.						
CONTRACT 1A0052	TOTAL AMOUNT = $				661984.80								
				100684.	511600.	49702.							
CONTRACT 1A0061	TOTAL AMOUNT = $				461017.00								
			150656.	310362.									
CONTRACT 1A0063*	TOTAL AMOUNT = $				10769001.00								
				3589667.	3589667.	3589667.							
CONTRACT 1A0064	TOTAL AMOUNT = $				1144164.86								
				71434.	1001480.	71251.							
CONTRACT 1A0071	TOTAL AMOUNT = $				1686591.79								
				76308.	1238774.	291509.	80000.						
CONTRACT 1A0072	TOTAL AMOUNT = $				2629979.84								
					682964.	1284891.	434101.	128024.		100000.			
CONTRACT 1A0074	TOTAL AMOUNT = $				161045.54								
										144572.	15973.	500.	
CONTRACT 1A0077	TOTAL AMOUNT = $				4894217.81								
											2710383.	2183834.	
CONTRACT 1A0081	TOTAL AMOUNT = $				3078572.44								
						698000.	2185635.	184585.	10353.				
CONTRACT 1A0091	TOTAL AMOUNT = $				1789726.92								
						398671.	1190593.	195713.	3500.	1250.			
CONTRACT 1A0092	TOTAL AMOUNT = $				1397139.80								
					540289.	792410.	64440.						
CONTRACT 1A3091	TOTAL AMOUNT = $				1233428.08								
							674871.	484586.	73972.				
CONTRACT 1A3424	TOTAL AMOUNT = $				120537.59								
									102048.	18489.			
CONTRACT 1A3421	TOTAL AMOUNT = $				98067.96								
							76855.	21213.					
CONTRACT 1A1021	TOTAL AMOUNT = $				1030582.26								
							430664.	394097.	205821.				
CONTRACT 1A1011	TOTAL AMOUNT = $				4539370.92								
					523135.	2280889.	1036997.	698350.					

Source: McDonald & Grefe, Inc.

Table B-6 (continued)

REGIONAL CONSTRUCTION CONTRACTS : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1A3051	TOTAL AMOUNT = $	1281721.40											
					194141.	604491.	404978.	76112.					
CONTRACT 1A3011	TOTAL AMOUNT = $	1145525.37											
					175966.	714134.	196536.	58833.					
CONTRACT 1A3021	TOTAL AMOUNT = $	1207183.18											
					249480.	645060.	214276.	96867.	1500.				
CONTRACT 1A3061	TOTAL AMOUNT = $	1054122.96											
					314433.	597269.	35973.	106428.					
CONTRACT 1A3041	TOTAL AMOUNT = $	1015161.41											
					408573.	492613.	20596.	80660.	12719.				
CONTRACT 1A3042	TOTAL AMOUNT = $	1088854.60											
					376588.	612570.	30366.	69330.					
CONTRACT 1A3081*	TOTAL AMOUNT = $	1240000.00											
			1240000.										
CONTRACT 180031	TOTAL AMOUNT = $	15235074.44											
					4993455.	9065566.	926054.				250000.		
CONTRACT 180033	TOTAL AMOUNT = $	1400674.22											
			71942C.	522C18.		84236.	75000.						
CONTRACT 180041	TOTAL AMOUNT = $	2571956.73											
			870512.	1542344.		159101.							
CONTRACT 1C0021*	TOTAL AMOUNT = $	30597999.00											
			10199333.	10199333.		10199333.							
CONTRACT 1C0041	TOTAL AMOUNT = $	31625432.35											
	5128500.	12647470.	5826273.	6263413.		1755777.							
CONTRACT 1C0051*	TOTAL AMOUNT = $	39201000.00											
				13067000.		13067000.	13067000.						
CONTRACT 1C0151*	TOTAL AMOUNT = $	350000.00											
						350000.							
CONTRACT 1C0181	TOTAL AMOUNT = $	2931978.32											
						631571.	2047560.	202847.					
CONTRACT 1C1162*	TOTAL AMOUNT = $	110000.00											
							110000.						
CONTRACT 1C3061	TOTAL AMOUNT = $	1028730.19											
							93134.	787758.	120772.	27066.			
CONTRACT 1C3071	TOTAL AMOUNT = $	1172673.00											
							578636.	514266.	79771.				
CONTRACT 1C3161	TOTAL AMOUNT = $	511207.94											
		245214.	265994.										
CONTRACT 1C3152	TOTAL AMOUNT = $	25612.00											
	25612.												
CONTRACT 1C3011	TOTAL AMOUNT = $	1323781.68											
							276682.	905413.	114510.	27178.			
CONTRACT 1C1011	TOTAL AMOUNT = $	4729021.37											
						192004.	944464.	1165640.	916298.	237418.	1273197.		
CONTRACT 2C0065	TOTAL AMOUNT = $	30792.30											
					30792.								

Source: McDonald & Grefe, Inc.

Table B-6 (continued)

REGIONAL CONSTRUCTION CONTRACTS : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1C0001 TOTAL AMOUNT = $ 4773933.84													
								2901159.	1441215.	[illegible]	[illegible]		
CONTRACT 1C0161 TOTAL AMOUNT = $ 1748477.57													
	1303045.	[illegible]430.											
CONTRACT 1C1161 TOTAL AMOUNT = $ 994647.00													
		775147.	111604.						107396.				
CONTRACT 1C3051 TOTAL AMOUNT = $ 1524789.48													
							221385.	977266.	142275.	[illegible]	[illegible]		
CONTRACT 1C3082 TOTAL AMOUNT = $ 1471822.04													
						44764.	995473.	357205.	74381.				
CONTRACT 1C0172* TOTAL AMOUNT = $ 140000.00													
									140000.				
CONTRACT 1K0012* TOTAL AMOUNT = $ 50000.00													
						50000.							
CONTRACT 1K0017* TOTAL AMOUNT = $ 540000.00													
				540000.									
CONTRACT 1K0016 TOTAL AMOUNT = $ 20139762.84													
				6313011.	11001615.	1872694.	947442.	5000.					
CONTRACT 1K3014 TOTAL AMOUNT = $ 2557230.87													
							1168329.	1165793.	185602.	36715.	793.		
CONTRACT 1K3013 TOTAL AMOUNT = $ 2621580.69													
							1137460.	1230850.	211676.	41594.			
CONTRACT 1K3015 TOTAL AMOUNT = $ 871269.60													
												596976.	274293.
CONTRACT 1K0021 TOTAL AMOUNT = $ 2789016.35													
					2434363.	354654.							
CONTRACT 1K0071 TOTAL AMOUNT = $ 6532760.77													
				1245009.	3435435.	1530720.	321597.						
CONTRACT 1K0073 TOTAL AMOUNT = $ 3123083.00													
							1374921.	1552103.	196059.				
CONTRACT 1K0081 TOTAL AMOUNT = $ 874920.01													
					19482.	685589.	141718.	28132.					
CONTRACT 1K0082* TOTAL AMOUNT = $ 520000.00													
						520000.							
CONTRACT 1K0085 TOTAL AMOUNT = $ 241558.95													
										189280.	52279.		
CONTRACT 1K1011 TOTAL AMOUNT = $ 2875361.46													
						324035.	670057.	787372.	1093898.				
CONTRACT 1K3021 TOTAL AMOUNT = $ 1357392.94													
							509875.	766842.	80677.				
CONTRACT 1K3073 TOTAL AMOUNT = $ 1420041.86													
							964166.	441776.	14100.				
CONTRACT 1K3074* TOTAL AMOUNT = $ 390000.00													
								390000.					
CONTRACT 1M0012 TOTAL AMOUNT = $ 6373794.60													
					2755103.	2171542.	1435270.	11880.					

Source: McDonald & Grefe, Inc.

Table B-6 (continued)

REGIONAL CONSTRUCTION CONTRACTS : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1MC013	TOTAL AMOUNT = $	6C0404C.16										
			3188827.	1795388.	1017825.							
CONTRACT 1MC032	TOTAL AMOUNT = $	230CCC.CC										
				23C000.								
CONTRACT 1MC074*	TOTAL AMOUNT = $	110000.00										
					110000.							
CONTRACT 1MC055	TOTAL AMOUNT = $	46431.89										
		28080.	18352.									
CONTRACT 1M3012	TOTAL AMOUNT = $	1449C82.59										
					421181.	922023.	105879.					
CONTRACT 1M3011	TOTAL AMOUNT = $	144C853.50										
					356909.	929518.	154467.					
CONTRACT 1MC011	TOTAL AMOUNT = $	12804662.70										
		2521498.	5680243.	4456342.	146575.							
CONTRACT 1M0043	TOTAL AMOUNT = $	3567219.99										
				2609373.	898247.	59600.						
CONTRACT 1M0042	TOTAL AMOUNT = $	4711947.85										
			2216562.	2257336.	238050.							
CONTRACT 1MC073	TOTAL AMOUNT = $	323436.26										
					210030.	113407.						
CONTRACT 1M0071	TOTAL AMOUNT = $	4148123.87										
						1277679.	1959209.	804994.	41742.	64500.		
CONTRACT 1MC061	TOTAL AMOUNT = $	3C68854.56										
				1391260.	1520793.	156802.						
CONTRACT 1M4071	TOTAL AMOUNT = $	0.00										
CONTRACT 1M0051	TOTAL AMOUNT = $	8855624.03										
				5436646.	2913535.	505443.						
CONTRACT 1M3072	TOTAL AMOUNT = $	347977.74										
												347978.
CONTRACT 1M3051	TOTAL AMOUNT = $	1325808.69										
					39822.	1074510.	211477.					
CONTRACT 1M3041	TOTAL AMOUNT = $	1466501.25										
					58366.	984085.	424050.					
CONTRACT 1R0011*	TOTAL AMOUNT = $	27390CCC.CC										
	9130000.	9130000.	9130000.									
CONTRACT 1RC052*	TOTAL AMOUNT = $	9738999.00										
	3246333.	3246333.	3246333.									
CONTRACT 1RC057*	TOTAL AMOUNT = $	23436000.CC										
				7812000.	7812000.	7812000.						
CONTRACT 1R0071	TOTAL AMOUNT = $	1881257.CC										
119748.	1630730.	130778.										
CONTRACT 1R0050	TOTAL AMOUNT = $	4678817.37										
					2663766.	1783040.	232012.					
CONTRACT 1RC054C	TOTAL AMOUNT = $	3924020.62										
			333473.	2758213.	828053.	4282.						

Source: McDonald & Grefe, Inc.

Table B-6 (continued)

REGIONAL CONSTRUCTION CONTRACTS : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1R0101	TOTAL AMOUNT = $	4255803.56											
					442792.	2945326.	670780.	196916.					
CONTRACT 1R3058	TOTAL AMOUNT = $	1263695.83											
						579560.	617626.	66514.					
CONTRACT 1R3050	TOTAL AMOUNT = $	1347411.66											
							439183.	831532.	53661.	23035.			
CONTRACT 1R3421	TOTAL AMOUNT = $	92130.49											
								75479.	16651.				
CONTRACT 1R3412	TOTAL AMOUNT = $	228047.61											
					211701.	16346.							
CONTRACT 1R3402	TOTAL AMOUNT = $	185368.36											
							141991.	34539.	3838.				
CONTRACT 1R1011	TOTAL AMOUNT = $	2824798.12											
						640610.	1168567.	527207.	488614.				
CONTRACT 1R3082	TOTAL AMOUNT = $	1509741.15											
						758068.	603950.	131423.	16301.				
CONTRACT 1R3031	TOTAL AMOUNT = $	1490862.76											
						835492.	523284.	110292.	11794.				
CONTRACT 1R0051	TOTAL AMOUNT = $	6128542.92											
			289226.	2766977.	2649948.	417418.	4974.						
CONTRACT 1R0091	TOTAL AMOUNT = $	3561343.10											
				617031.	2318437.	625876.							
CONTRACT 1R3101*	TOTAL AMOUNT = $	2300000.00											
							2300000.						
CONTRACT 1R3052	TOTAL AMOUNT = $	2479754.76											
						732899.	1603457.	143399.					
CONTRACT 1R3011	TOTAL AMOUNT = $	1659555.67											
				261070.	962954.	271832.		164100.					
CONTRACT 1R4051*	TOTAL AMOUNT = $	170000.00											
							170000.						
CONTRACT 1S3011	TOTAL AMOUNT = $	3209129.68											
						370721.	2484954.	349144.	4311.				
CONTRACT 1S3012	TOTAL AMOUNT = $	3223663.29											
						261151.	2265836.	683469.	13207.				
CONTRACT 1S1011*	TOTAL AMOUNT = $	3140000.00											
							3140000.						
CONTRACT 1S3101	TOTAL AMOUNT = $	0.00											
CONTRACT 1S0041*	TOTAL AMOUNT = $	8110000.00											
												8110000.	
CONTRACT 1S3051	TOTAL AMOUNT = $	14034807.64											
									2564895.	6465487.	3498733.	515692.	
CONTRACT 1S3014	TOTAL AMOUNT = $	5240041.26											
							989242.	2281929.	1543431.	425439.			
CONTRACT 1S3013	TOTAL AMOUNT = $	888057.54											
							87725.	619625.	180308.				

Source McDonald & Grefe, Inc.

Table B-6 (continued)

REGIONAL CONSTRUCTION CONTRACTS : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1S0012	TOTAL AMOUNT = $	14853188.93											
			1226022.	5806565.	4981617.	2829870.	7914.						
CONTRACT 1S3026	TOTAL AMOUNT = $	1999982.51											
										260076.	639013.	199693.	1200.
CONTRACT 1S0022	TOTAL AMOUNT = $	18097716.86											
			1756107.	12562230.	2142623.	1440837.				195922.			
CONTRACT 1S3022	TOTAL AMOUNT = $	2408831.58											
								36911.	1245440.	1110002.	16480.		
CONTRACT 1S0024	TOTAL AMOUNT = $	11033459.55											
								4389892.	4555992.	1517142.	570433.		
CONTRACT 1S0033	TOTAL AMOUNT = $	11825555.72											
										2327754.	5560156.	2891141.	52505.
CONTRACT 1S0032	TOTAL AMOUNT = $	9927111.10											
										3418314.	4559510.	1933184.	16104.
CONTRACT 1S0036	TOTAL AMOUNT = $	1411690.23											
									1223322.	171374.	16994.		
CONTRACT 1S0031	TOTAL AMOUNT = $	11994093.78											
								6067842.	4706578.	1219673.			
CONTRACT 1S3021	TOTAL AMOUNT = $	3221709.30											
						233005.	1806632.	1182073.					
CONTRACT 1S3015	TOTAL AMOUNT = $	2102261.73											
									1407733.	676660.	17269.	500.	
CONTRACT 1S1001	TOTAL AMOUNT = $	5298392.25											
						424977.	1301268.	1777820.	403652.	47520.	1646134.		
CONTRACT 1T0012*	TOTAL AMOUNT = $	330000.00											
		330000.											
CONTRACT 1T0013	TOTAL AMOUNT = $	3141340.33											
					883345.	2033699.	219297.						
CONTRACT 1T0018	TOTAL AMOUNT = $	2080885.29											
										946673.	1134213.		
CONTRACT 1T0019*	TOTAL AMOUNT = $	40000.00											
								40000.					
CONTRACT 1T0020*	TOTAL AMOUNT = $	40000.00											
		40000.											
CONTRACT 1T0361	TOTAL AMOUNT = $	3126495.55											
			530950.	1412775.	822337.	360434.							
CONTRACT 1Z4562	TOTAL AMOUNT = $	352890.41											
									62871.	330019.			
CONTRACT 1Z3152	TOTAL AMOUNT = $	822373.37											
								275945.	489642.	56786.			
CONTRACT 1Z3150	TOTAL AMOUNT = $	2245605.04											
						43605.	1835127.	278743.	83131.				
CONTRACT 1Z3171	TOTAL AMOUNT = $	580174.64											
								112413.	412169.	55593.			
CONTRACT 1Z3170	TOTAL AMOUNT = $	384761.90											
						153594.	210206.	21002.					

Source: McDonald & Grefe, Inc.

Table B-6 (continued)

REGIONAL CONSTRUCTION CONTRACTS : BY YEAR OF EXPENDITURE

				CONTRACT AMOUNT PER YEAR								
1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
TRACT 123314	TOTAL AMOUNT = $		138344.00									
TRACT 129000	TOTAL AMOUNT = $		454992.63						114993.	19351.		
TRACT 129005	TOTAL AMOUNT = $		284368.32					324394.	130599.			
TRACT 129009	TOTAL AMOUNT = $		226038.93							231273.	53096.	
TRACT 123156	TOTAL AMOUNT = $		515638.89							157987.	68052.	
TRACT 123157	TOTAL AMOUNT = $		446774.78				71231.	424408.	15000.	5000.		
TRACT 221016	TOTAL AMOUNT = $		3191250.40				307441.	139333.				
TRACT 124533	TOTAL AMOUNT = $		576786.10								3066874.	124377.
TRACT 124060	TOTAL AMOUNT = $		439218.90			18675.	386792.	120749.	53572.			
TRACT 124503	TOTAL AMOUNT = $		972713.76								236759.	202460.
TRACT 124497	TOTAL AMOUNT = $		3199167.73						142940.	607136.	208401.	14236.
TRACT 221019	TOTAL AMOUNT = $		1382074.89					90000.	2631659.	477509.		
TRACT 222018	TOTAL AMOUNT = $		248736.79								1382075.	
TRACT 124485	TOTAL AMOUNT = $		1554740.10					82487.	120413.	45836.		
TRACT 129006	TOTAL AMOUNT = $		256575.74			388243.	1045182.	121315.				
TRACT 129004	TOTAL AMOUNT = $		249358.96						67404.	184046.	25131.	
TRACT 124561	TOTAL AMOUNT = $		302601.98						147605.	101754.		
TRACT 124493*	TOTAL AMOUNT = $	60000.	60000.00				126744.	175858.				
TRACT 123149*	TOTAL AMOUNT = $	290000.	290000.00									
TRACT 123151*	TOTAL AMOUNT = $		380000.00		380000.							
TRACT 123153*	TOTAL AMOUNT = $		840000.00	840000.								
TRACT 123155*	TOTAL AMOUNT = $	650000.	650000.00									
TRACT 123158*	TOTAL AMOUNT = $		620000.00	620000.								

Source: McDonald & Grefe, Inc.

Table B-6 (continued)

REGIONAL CONSTRUCTION CONTRACTS : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 123159* TOTAL AMOUNT = $				530000.00		530000.							
CONTRACT 124492* TOTAL AMOUNT = $				200000.00			200000.						
CONTRACT 124491* TOTAL AMOUNT = $				90000.00					90000.				
CONTRACT 124563* TOTAL AMOUNT = $				130000.00		130000.							
CONTRACT 124505* TOTAL AMOUNT = $				80000.00	80000.								
CONTRACT 124502* TOTAL AMOUNT = $				400000.00					400000.				
CONTRACT 123310* TOTAL AMOUNT = $				260000.00	260000.								
CONTRACT 124535* TOTAL AMOUNT = $				80000.00					80000.				
CONTRACT 124570* TOTAL AMOUNT = $				40000.00		40000.							

Source: McDonald & Grefe, Inc.

Table B -7

REGIONAL PROCUREMENT CONTRACTS : AMOUNTS BY YEAR

TOTAL CONTRACT AMOUNTS AND PERCENT

1964	$	0.00	0.00 PCT.
1965	$	0.00	0.00 PCT.
1966	$	2456935.09	4.14 PCT.
1967	$	5083951.84	8.56 PCT.
1968	$	9554263.82	16.10 PCT.
1969	$	12108940.99	20.40 PCT.
1970	$	9040209.13	15.23 PCT.
1971	$	9558025.05	16.10 PCT.
1972	$	4864686.77	8.20 PCT.
1973	$	2005325.80	3.38 PCT.
1974	$	1608652.54	2.71 PCT.
1975	$	3077330.36	5.18 PCT.
1976	$	0.00	0.00 PCT.
TOTAL	$	59358321.39	100.00 PCT.

Source: McDonald & Grefe, Inc.

Table B-8

REGIONAL PROCUREMENT CONTRACTS : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 124791	TOTAL AMOUNT = $		7754485.75									
				45000.	153000.		542436.	2636108.	1603228.	657227.	1799277.	
CONTRACT 224589	TOTAL AMOUNT = $		2571.23									
		2571.										
CONTRACT 220015	TOTAL AMOUNT = $		540866.79									
					113501.	275941.	139317.	8233.	3870.			
CONTRACT 221010	TOTAL AMOUNT = $		2404979.16									
					35497.	1308944.	825274.	237000.	9136.	9158.		
CONTRACT 150013	TOTAL AMOUNT = $		1730741.53									
							810704.	920038.				
CONTRACT 224487	TOTAL AMOUNT = $		2530338.26									
				338036.	1213813.	777902.	200588.					
CONTRACT 221014	TOTAL AMOUNT = $		8508112.12									
					1332721.	3109596.	3369362.	596432.				
CONTRACT 224316	TOTAL AMOUNT = $		27404537.31									
		2454364.	5083952.	9171228.	9260409.	1252181.	182404.					
CONTRACT 221014	TOTAL AMOUNT = $		73206.95									
									32022.	41185.		
CONTRACT 124487	TOTAL AMOUNT = $		6650429.03									
						2215646.	3006940.	466873.		900973.		
CONTRACT 224788	TOTAL AMOUNT = $		1278053.26									
											1278053.	

Source: McDonald & Grefe, Inc.

Table B-9

EXTRA-REGIONAL CONSTRUCTION CONTRACTS : AMOUNTS BY YEAR

	TOTAL CONTRACT AMOUNTS AND PERCENT		
1964	$	36707.90	.01 PCT.
1965	$	3324599.84	1.03 PCT.
1966	$	16347218.10	5.04 PCT.
1967	$	56143746.97	17.32 PCT.
1968	$	88938672.58	27.43 PCT.
1969	$	81096787.12	25.01 PCT.
1970	$	46335069.36	14.29 PCT.
1971	$	21409263.72	6.60 PCT.
1972	$	6650712.31	2.05 PCT.
1973	$	3748324.51	1.16 PCT.
1974	$	37113.95	.01 PCT.
1975	$	168701.94	.05 PCT.
1976	$	0.00	0.00 PCT.
TOTAL	$	324236918.30	100.00 PCT.

Source: McDonald & Grefe, Inc.

Table B -10

EXTRA-REGIONAL CONSTRUCTION CONTRACTS : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 1B0021	TOTAL AMOUNT = $ 6233519.55												
			1556286.	4240933.	436701.								
CONTRACT 1CC011*	TOTAL AMOUNT = $ 1785999.00												
			595333.	595333.	595333.								
CONTRACT 1C4161	TOTAL AMOUNT = $ 1154696.11												
	1083707.	70989.											
CONTRACT 1CCC71	TOTAL AMOUNT = $ 3637382.98												
				2371835.	1074989.	191060.							
CONTRACT 1CC171	TOTAL AMOUNT = $ 2447628.22												
55706.	2240893.	169992.	35.										
CONTRACT 1C0043	TOTAL AMOUNT = $ 1111514.10												
					1045111.	66403.							
CONTRACT 1K0061	TOTAL AMOUNT = $ 15888560.02												
			188213.	6977895.	7463783.	1258669.							
CONTRACT 1K0013	TOTAL AMOUNT = $ 4132102.19												
		532105.	2300384.	1148743.	100870.								
CONTRACT 1K0014	TOTAL AMOUNT = $ 8203486.07												
		391037.	1403139.	5388968.	892242.	3100.						125000.	
CONTRACT 1K0015	TOTAL AMOUNT = $ 16034009.58												
			5606694.	7136794.	2442607.	823451.	24464.						
CONTRACT 1K0051	TOTAL AMOUNT = $ 4409404.08												
		1742432.	2452319.	214653.									
CONTRACT 1M0041	TOTAL AMOUNT = $ 9651865.37												
				1442162.	5376040.	2833664.							
CONTRACT 1M0031	TOTAL AMOUNT = $ 11574260.45												
				1544516.	9209604.	816759.	2617.	613.	150.				
CONTRACT 1R0053	TOTAL AMOUNT = $ 7852155.98												
		52512.	3119679.	3777583.	887983.	1000.	13000.						
CONTRACT 1R0052	TOTAL AMOUNT = $ 5899673.74												
			5164537.	735137.									
CONTRACT 1R0057C	TOTAL AMOUNT = $ 3863469.76												
				966556.	2529904.	367010.							
CONTRACT 1R0058C	TOTAL AMOUNT = $ 2537312.92												
				1215333.	906499.	415482.							
CONTRACT 1R0081	TOTAL AMOUNT = $ 4817915.29												
		517673.	3777837.	512405.	10000.								
CONTRACT 1R0021	TOTAL AMOUNT = $ 2284231.70												
		238427.	1867174.	178631.									
CONTRACT 1S0011	TOTAL AMOUNT = $ 9267290.77												
			98899.	722343.	7459382.	986666.							
CONTRACT 1S0013	TOTAL AMOUNT = $ 14423288.15												
			786846.	6627477.	4843778.	2165187.							
CONTRACT 1S0051A	TOTAL AMOUNT = $ 22240817.66												
					6110063.	7517185.	5545094.	1826720.	1241755.				
CONTRACT 1S0023	TOTAL AMOUNT = $ 20605430.45												
			135966C.	5723318.	4140699.	7292326.	2089427.						

Source: McDonald & Grefe, Inc.

Table B-10 (continued)

EXTRA-REGIONAL CONSTRUCTION CONTRACTS : BY YEAR OF EXPENDITURE

CONTRACT AMOUNT PER YEAR

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 150021	TOTAL AMOUNT = $	10548196.18											
							9243665.	1307531.					
CONTRACT 170011	TOTAL AMOUNT = $	94007860.00											
		12582050.	25866715.	35258712.	18675996.	1624887.							
CONTRACT 170016	TOTAL AMOUNT = $	1032873.17											
			158664.	238743.	363946.	236520.							
CONTRACT 170017	TOTAL AMOUNT = $	2412951.60											
							455327.	1910045.	47579.				
CONTRACT 124793	TOTAL AMOUNT = $	644478.49											
									563663.	37114.	43702.		
CONTRACT 122014	TOTAL AMOUNT = $	2451001.58											
						559134.	1134662.	612579.	144627.				
CONTRACT 122013	TOTAL AMOUNT = $	471809.54											
				58673.	114525.	117773.	180833.						
CONTRACT 124482	TOTAL AMOUNT = $	9549309.83											
				327964.	4381734.	2315232.	773829.	1750551.					
CONTRACT 124481	TOTAL AMOUNT = $	11530501.57											
			2000782.	5409824.	1905890.	2214006.							
CONTRACT 124483	TOTAL AMOUNT = $	9516027.20											
					3271326.	5123609.	1121092.						
CONTRACT 124481	TOTAL AMOUNT = $	5000.00											
								5000.					
CONTRACT 122015+	TOTAL AMOUNT = $	590000.00											
				590000.									
CONTRACT 124527+	TOTAL AMOUNT = $	220000.00											
								220000.					
CONTRACT 124526+	TOTAL AMOUNT = $	50000.00											
							50000.						
CONTRACT 124061+	TOTAL AMOUNT = $	130000.00											
						130000.							
CONTRACT 122016	TOTAL AMOUNT = $	70000.00											
				70000.									
CONTRACT 224522+	TOTAL AMOUNT = $	130000.00											
							130000.						
CONTRACT 124520+	TOTAL AMOUNT = $	80000.00											
							80000.						
CONTRACT 224535	TOTAL AMOUNT = $	30000.00											
				30000.									
CONTRACT 224585+	TOTAL AMOUNT = $	120000.00											
							120000.						
CONTRACT 264163+	TOTAL AMOUNT = $	130000.00											
				130000.									
CONTRACT 224586+	TOTAL AMOUNT = $	40000.00											
				40000.									
CONTRACT 264151+	TOTAL AMOUNT = $	50000.00											
							50000.						

Source: McDonald & Grefe, Inc.

Table B-11

EXTRA-REGIONAL PROCUREMENT CONTRACTS : AMOUNTS BY YEAR

TOTAL CONTRACT AMOUNTS AND PERCENT

1964	$	0.00	0.00 PCT.
1963	$	0.00	0.00 PCT.
1966	$	0.00	0.00 PCT.
1967	$	26018.59	.01 PCT.
1968	$	960062.02	.49 PCT.
1969	$	3660415.35	1.86 PCT.
1970	$	9279962.83	4.71 PCT.
1971	$	14419876.21	7.32 PCT.
1972	$	35339586.71	17.94 PCT.
1973	$	41183452.40	20.91 PCT.
1974	$	54227014.52	27.53 PCT.
1975	$	37814440.30	19.20 PCT.
1976	$	55610.71	.03 PCT.
TOTAL	$	196966439.64	100.00 PCT.

Source: McDonald & Grefe, Inc.

Table B-12

EXTRA-REGIONAL PROCUREMENT CONTRACTS : BY YEAR OF EXPENDITURE

		CONTRACT AMOUNT PER YEAR											
	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
CONTRACT 122011	TOTAL AMOUNT = $ 4354715.09												
				26019.	496047.	1337117.	2495533.						
CONTRACT 122012	TOTAL AMOUNT = $ 1508516.76												
					152596.	239027.	250675.	532533.			343286.		
CONTRACT 124602	TOTAL AMOUNT = $ 152269777.57												
						500000.	2539826.	7692563.	25374019.	29758082.	47964731.	36440496.	
CONTRACT 124552	TOTAL AMOUNT = $ 172020.60												
												116410.	55611.
CONTRACT 122011	TOTAL AMOUNT = $ 28745412.48												
								2800430.	8964322.	10483873.	5476032.	1090689.	
CONTRACT 124551	TOTAL AMOUNT = $ 2539747.29												
					311020.	1058014.	220271.	320256.	66884.	215792.	180665.	166646.	
CONTRACT 124552	TOTAL AMOUNT = $ 2828161.72												
								1206043.	596880.	696602.	328637.		
CONTRACT 221011	TOTAL AMOUNT = $ 6548088.13												
						526257.	3773658.	1868051.	337482.	29097.	3543.		

Source: McDonald & Grefe, Inc.

APPENDIX C

ETHNIC COMPOSITION
BART ON-SITE CONSTRUCTION WORK FORCE

APPENDIX C

ETHNIC COMPOSITION
BART ON-SITE CONSTRUCTION WORK FORCE
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Table C-1

BART ON-SITE CONSTRUCTION WORK FORCE
SUMMARY
October, 1967

	Total	Negro	Spanish	Oriental	American Indian
Journeyman	2,148	554	199	10	15
Foreman	309	27	24	-	5
Apprentice	52	6	4	-	-
GRAND TOTAL	2,509	587	227	10	20
Percent	100	23.0	9.0	0.4	0.8

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, October 1967.

Table C-2

BART ON-SITE CONSTRUCTION WORK FORCE
JOURNEYMAN
October, 1967

	Journeyman Total	Negro	Spanish	Oriental	American Indian
Carpenter					
Pile Driver	536	57	21	2	3
Engineer Surveyor	329	6	12	2	2
Ironworkers	111	-	14	-	-
Teamster	97	8	5	1	1
Cement Finisher	62	34	4	-	-
Laborer	927	438	141	5	8
Electrician	60	6	2	-	-
Plumber	29	2	-	-	-
Bricklayer					
Elevator Constructors					
Glazier-Building Construction					
Lather					
Painters					
Plasterers					
Roofers					
Sheetmetal Workers					
Tile Setters					
Tile Setters' Helpers					
Terrazzo Workers					
Insulators					
Marble Setters					
Others (1968)					
TOTALS	2,148	554	199	10	15

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, October 1967.

Table C-3

BART ON-SITE CONSTRUCTION WORK FORCE
FOREMAN
October, 1967

	Foreman Total	Negro	Spanish	Oriental	American Indian
Carpenter					
Pile Driver	116	1	6	-	2
Engineer Surveyor	26	1	1	-	-
Ironworker	30	-	2	-	-
Teamster	4	-	-	-	-
Cement Finisher	12	5	-	-	-
Laborer	99	20	15	-	3
Electrician	17	-	-	-	-
Plumber	5	-	-	-	-
Bricklayer					
Elevator Constructors					
Glazier-Building Construction					
Lather					
Painters					
Plasterers					
Roofers					
Sheetmetal Workers					
Tile Setters					
Tile Setters' Helpers					
Terrazzo Workers					
Insulators					
Marble Setters					
Others (1968)				-	-
TOTALS	309	27	24	-	5

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, October 1967.

Table C-4

BART ON-SITE CONSTRUCTION WORK FORCE
APPRENTICE
October, 1967

	Apprentice Total	Negro	Spanish	Oriental	American Indian
Carpenter					
Pile Driver	21	1	2	-	-
Engineer Surveyor	19	1	-	-	-
Ironworker	-	-	1	-	-
Teamster	1	-	-	-	-
Cement Finisher	-	-	-	-	-
Laborer	7	4	1	-	-
Electrician					
Plumber					
Bricklayer					
Elevator Constructors					
Glazier-Building Construction					
Lather					
Painters					
Plasterers					
Roofers					
Sheetmetal Workers					
Tile Setters					
Tile Setters' Helpers					
Terrazzo Workers					
Insulators					
Marble Setters					
Others (1968)	—	—	—	—	—
TOTALS	48	6	4	-	-

Source: BART Construction Contractor and-Sub-Contractor Ethnic Data Counts, October 1967

Table C-5

BART ON-SITE CONSTRUCTION WORK FORCE
SUMMARY
December, 1968

	Total	Negro	Spanish	Oriental	American Indian
Journeyman	2,615	627	245	9	31
Foreman	310	48	11	10	2
Apprentice	33	8	8	1	3
GRAND TOTAL	2,958	683	264	12	36
Percent	100	23.0	9.0	0.4	0.1

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, December 1968.

Table C-6

BART ON-SITE CONSTRUCTION WORK FORCE
JOURNEYMAN
December, 1968

	Journeyman Total	Negro	Spanish	Oriental	American Indian
Carpenter					
Pile Driver	583	79	34	-	15
Engineer Surveyor	333	1	2	4	-
Ironworker	158	2	22	1	8
Teamster	105	8	10	-	-
Cement Finisher	102	60	7	-	-
Laborer	1,128	463	162	4	7
Electrician	112	9	3	-	-
Plumber	41	-	-	-	1
Bricklayer					
Elevator Constructors					
Glazier-Building Construction					
Lather					
Painters					
Plasterers					
Roofers					
Sheetmetal Workers					
Tile Setters					
Tile Setters' Helpers					
Terrazzo Workers					
Insulators					
Marble Setters					
Other (1968)	52	5	5	-	-
TOTALS	2,614	627	245	9	31

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, December 1968.

Table C-7

BART ON-SITE CONSTRUCTION WORK FORCE
FOREMAN
December, 1968

	Foreman Total	Negro	Spanish	Oriental	American Indian
Carpenter					
Pile Driver	91	9	2	-	-
Engineer Surveyor	23	1	-	-	-
Ironworker	27	-	1	-	-
Teamster	4	-	-	-	-
Cement Finisher	20	12	-	-	-
Laborer	109	26	8	-	2
Electrician	22	-	-	-	-
Plumber	11	-	-	-	-
Bricklayer					
Elevator Constructors					
Glazier-Building Construction					
Lather					
Painters					
Plasterers					
Roofers					
Sheetmetal Workers					
Tile Setters					
Tile Setters' Helpers					
Terrazzo Workers					
Insulators					
Marble Setters					
Other (1968)	3	—	—	-	-
TOTALS	310	48	11	-	2

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, December 1968.

Table C-8

BART ON-SITE CONSTRUCTION WORK FORCE
APPRENTICE
December, 1968

	Apprentice Total	Negro	Spanish	Oriental	American Indian
Carpenter					
Pile Driver	16	8	-	-	1
Engineer Surveyor	3	-	2	-	-
Ironworker	2	-	1	-	-
Teamster	-	-	-	-	-
Cement Finisher	-	-	-	-	1
Laborer	-	-	-	-	-
Electrician	11	-	1	1	1
Plumber	1	-	-	-	-
Bricklayer					
Elevator Constructors					
Glazier-Building Construction					
Lather					
Painters					
Plasterers					
Roofers					
Sheetmetal Workers					
Tile Setters					
Tile Setters' Helpers					
Terrazzo Workers					
Insulators					
Marble Setters					
Other (1968)					
TOTALS	33	8	4	1	3

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, December 1968.

Table C -9

BART ON-SITE CONSTRUCTION WORK FORCE
SUMMARY
October, 1969

	Total	Negro	Spanish	Oriental	American Indian
Journeyman	1,849	461	315	10	14
Foreman	288	24	24	-	2
Apprentice	64	14	6	-	-
GRAND TOTALS	2,201	499	345	10	16
Percent	100.0	18.3	12.9	0.9	1.5

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, October 1969.

Table C-10

BART ON-SITE CONSTRUCTION WORK FORCE
JOURNEYMAN
October, 1969

	Journeyman Total	Negro	Spanish	Oriental	American Indian
Carpenter					
Pile Driver	303	52	28	1	5
Engineer Surveyor	346	1	8	3	1
Ironworker	63	-	6	1	5
Teamster	75	5	8	-	-
Cement Finisher	64	43	7	-	-
Laborer	773	346	255	3	2
Electrician	165	9	1	1	-
Plumber	19	-	-	1	-
Bricklayer	9	2	-	-	-
Elevator Constructors	14	1	-	-	-
Glazier-Building Construction	-	-	-		
Lather	-	-	-	-	-
Painters	2	1	-	-	-
Plasterers	1	-	-	-	-
Roofers	3	1	-	-	-
Sheetmetal Workers	7	-	1	-	-
Tile Setters	2	-	-	-	-
Tile Setters' Helpers	2	1	-	-	-
Terrazzo Workers					
Insulators					
Marble Setters					
Others (1968)					
TOTALS	1,849	461	315	10	14

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, October 1969.

Table C-11

BART ON-SITE CONSTRUCTION WORK FORCE
FOREMAN
October, 1969

	Foreman Total	Negro	Spanish	Oriental	American Indian
Carpenter					
Pile Driver	72	1	3	-	-
Engineer Surveyor	41	1	1	-	1
Ironworker	18	-	2	-	1
Teamster	-	-	-	-	-
Cement Finisher	20	6	1	-	-
Laborer	93	16	15	-	-
Electrician	34	-	2	-	-
Plumber	3	-	-	-	-
Bricklayer	-	-	-	-	-
Elevator Constructors	4	-	-	-	-
Glazier-Building Construction	-	-	-	-	-
Lather	-	-	-	-	-
Painters	-	-	-	-	-
Plasterers	-	-	-	-	-
Roofers	1	-	-	-	-
Sheetmetal Workers	2	-	-	-	-
Tile Setters					
Tile Setters' Helpers					
Terrazzo Workers					
Insulators					
Marble Setters					
Others (1968)	—	—	—	—	—
TOTALS	288	24	24	-	2

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, October 1969.

Table C-12

BART ON-SITE CONSTRUCTION WORK FORCE
APPRENTICE
October, 1969

	Apprentice Total	Negro	Spanish	Oriental	American Indian
Carpenter					
Pile Driver	34	7	5	-	-
Engineer Surveyor	5	2	-	-	-
Ironworker	6	-	-	-	-
Teamster	-	-	-	-	-
Cement Finisher	4	2	-	-	-
Laborer	-	-	-	-	-
Electrician	8	-	-	-	-
Plumber	-	-	-	-	-
Bricklayer	-	-	-	-	-
Elevator Constructors	7	3	1	-	-
Glazier-Building Construction					
Lather					
Painters					
Plasterers					
Roofers					
Sheetmetal Workers					
Tile Setters					
Tile Setters' Helpers					
Terrazzo Workers					
Insulators					
Marble Setters					
Others (1968)	—	—	—	—	—
TOTALS	64	14	6	-	-

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, October 1969.

Table C-13

BART ON-SITE CONSTRUCTION WORK FORCE
SUMMARY
August, 1970

	Total	Negro	Spanish	Oriental	American Indian
Journeyman	1,528	375	224	21	44
Foreman	192	23	19	-	2
Apprentice	46	4	4	2	-
GRAND TOTALS	1,766	402	247	23	46
Percent	100	23.	14.	1.0	3.0

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, August 1970.

Table C-14

BART ON-SITE CONSTRUCTION WORK FORCE
JOURNEYMAN
August, 1970

	Journeyman Total	Negro	Spanish	Oriental	American Indian
Carpenter					
Pile Driver	259	31	21	2	6
Engineer Surveyor	144	6	7	3	2
Ironworker	64	-	8	-	6
Teamster	35	9	6	1	-
Cement Finisher	86	52	3	-	23
Laborer	607	254	151	15	4
Electrician	222	10	23	-	3
Plumber	36	5	3	-	-
Bricklayer	16	1	-	-	-
Elevator Constructors	3	-	-	-	-
Glazier-Building Construction	-	-	-	-	-
Lather	12	1	1	-	-
Painters	7	1	1	-	-
Plasterers	7	1	-	-	-
Roofers	11	1	-	-	-
Sheetmetal Workers	19	3	-	-	-
Tile Setters					
Tile Setters' Helpers					
Terrazo Workers					
Insulators					
Marble Setters					
Others (1968)					
TOTALS	1,528	375	224	21	44

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, August 1970.

Table C-15

BART ON-SITE CONSTRUCTION WORK FORCE
FOREMAN
August, 1970

	Foreman Total	Negro	Spanish	Oriental	American Indian
Carpenter					
Pile Driver	33	2	3	-	-
Engineer Surveyor	7	-	-	-	-
Ironworker	12	-	-	-	1
Teamster	-	-	-	-	-
Cement Finisher	5	-	-	-	-
Laborer	68	20	10	-	1
Electrician	43	-	6	-	-
Plumber	11	-	-	-	-
Bricklayer	3	-	-	-	-
Elevator Constructors	2	-	-	-	-
Glazier-Building Construction	-	-	-	-	-
Lather	3	-	-	-	-
Painters	1	1	-	-	-
Plasterers	1	-	-	-	-
Roofers	1	-	-	-	-
Sheetmetal Workers	2	-	-	-	-
Tile Setters					
Tile Setters' Helpers					
Terrazo Workers					
Insulators					
Marble Setters					
Others (1968)	—	—	—	—	—
TOTALS	192	23	19	-	2

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, August 1970.

Table C-16

BART ON-SITE CONSTRUCTION WORK FORCE
APPRENTICE
August, 1970

	Apprentice Total	Negro	Spanish	Oriental	American Indian
Carpenter					
Pile Driver	17	3	1	2	-
Engineer Surveyor	-	-	-	-	-
Ironworker	-	-	-	-	-
Teamster	-	-	-	-	-
Cement Finisher	6	-	1	-	-
Laborer	-	-	-	-	-
Electrician	16	1	1	-	-
Plumber	-	-	-	-	-
Bricklayer	-	-	-	-	-
Elevator Constructors	7	-	1	-	-
Glazier-Building Construction					
Lather					
Painters					
Plasterers					
Roofers					
Sheetmetal Workers					
Tile Setters					
Tile Setter's Helpers					
Terrazo Workers					
Insulators					
Marble Setters					
Others (1968)	—	—	—	—	—
TOTALS	46	4	4	2	-

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, August 1970.

Table C-17

BART ON-SITE CONSTRUCTION WORK FORCE
SUMMARY
May, 1971

	Total	Negro	Spanish	Oriental	American Indian
Journeyman	1,410	266	197	12	18
Foreman	197	29	14	1	5
Apprentice	100	17	10	2	3
GRAND TOTALS	1,707	312	221	15	26
Percent	100	18.3	12.9	0.9	1.5

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, May 1971.

Table C -18

BART ON-SITE CONSTRUCTION WORK FORCE
JOURNEYMAN
May, 1971

	Journeyman Total	Negro	Spanish	Oriental	American Indian
Carpenter					
Pile Driver	125	14	8	-	1
Engineer Surveyor	129	3	13	1	2
Ironworker	65	2	10	1	2
Teamster	51	12	14	-	-
Cement Finisher	50	26	3	1	-
Laborer	598	184	114	6	5
Electrician	160	8	8	1	1
Plumber	20	1	-	-	1
Bricklayer	14	3	2	-	-
Elevator Constructors	29	1	2	-	2
Glazier-Building Construction	2	-	-	-	-
Lather	10	-	3	-	-
Painters	14	1	3	-	2
Plasterers	30	2	1	-	-
Roofers	5	-	-	1	-
Sheetmetal Workers	25	-	-	-	2
Tile Setters	34	3	8	1	-
Tile Setters' Helpers	37	4	5	-	-
Terrazzo Workers	8	2	1	-	-
Insulators	2	-	-	-	-
Marble Setters	2	-	2	-	-
Others (1968)					
TOTALS	1,410	266	197	12	18

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, May 1971

Table C-19

BART ON-SITE CONSTRUCTION WORK FORCE
FOREMAN
May, 1971

	Foreman Total	Negro	Spanish	Oriental	American Indian
Carpenter					
Pile Driver	23	1	1	-	3
Engineer Surveyor	11	-	-	-	-
Ironworker	10	-	-	-	-
Teamster	2	-	-	-	-
Cement Finisher	8	7	-	1	-
Laborer	50	17	9	-	1
Electrician	55	3	2	-	1
Plumber	6	-	-	-	-
Bricklayer	-	-	-	-	-
Elevator Constructors	6	-	-	-	-
Glazier-Building Construction	-	-	-	-	-
Lather	4	-	-	-	-
Painters	3	-	1	-	-
Plasterers	4	-	-	-	-
Roofers	-	-	-	-	-
Sheetmetal Workers	6	-	-	-	-
Tile Setters	7	1	-	-	-
Tile Setters' Helpers	-	-	-	-	-
Terrazzo Workers	1	-	-	-	-
Insulators	-	-	-	-	-
Marble Setters	1	-	-	-	-
Others (1968)					
TOTALS	197	29	14	1	5

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, May 1971

Table C-20

BART ON-SITE CONSTRUCTION WORK FORCE
APPRENTICE
May, 1971

	Apprentice Total	Negro	Spanish	Oriental	American Indian
Carpenter					
Pile Driver	9	1	1	1	1
Engineer Surveyor	4	1	-	-	-
Ironworker	1	-	1	-	-
Teamster	-	-	-	-	-
Cement Finisher	2	1	-	-	-
Laborer	-	-	-	-	-
Electrician	30	3	2	1	-
Plumber	2	-	-	-	-
Bricklayer	3	3	-	-	-
Elevator Constructors	28	2	3	-	2
Glazier-Building Construction	-	-	-	-	-
Lather	1	-	-	-	-
Painters	1	-	-	-	-
Plasterers	3	2	-	-	-
Roofers	-	-	-	-	-
Sheetmetal Workers	2	1	-	-	-
Tile Setters	3	1	2	-	-
Tile Setters' Helpers	-	-	-	-	-
Terrazzo Workers	-	-	-	-	-
Insulators	-	-	-	-	-
Marble Setters	10	1	1	-	-
Others (1968)	—	—	—	—	—
TOTALS	100	17	10	2	3

Source: BART Construction Contractor and Sub-Contractor Ethnic Data Counts, May 1971

APPENDIX D

A DIGRESSION ON REGIONAL MULTIPLIER ANALYSIS

APPENDIX D

A DIGRESSION ON REGIONAL MULTIPLIER ANALYSIS

One of the central analytic techniques underlying the analysis of BART's capital and operating expenditures is the calculation of the regional sales and income multiplier. In consideration of the importance of this analytical concept for this study's modeling and analysis, as well as the importance of particular techniques and conventions for transferability of these findings, this Appendix provides a general discussion of the regional multiplier.

A. Regional Sales and Income Multipliers

What is a regional sales and income multiplier?

The multiplier effect arises because a certain fraction of each dollar spent (for instance, on investment in regional transit facilities) is spent within the region (the "direct" regional impact). In turn, a portion of this fraction of the original dollar spent which stays in the region will also be spent in the region. The sum of all these "rounds" of local spending is the regional multiplier.

For example, if half of each dollar spent in a region, on the average, went to local businesses and households, we would have a total regional multiplier of two (change in final demand = \$1.00 + \$0.50 + \$0.25 + \$0.125 + ... = \$2.00). The time period within which these successive rounds of local spending will take place is irrelevant.

In practice the magnitude of the regional multiplier effect will depend upon the types of industries affected and upon the economic structure of the region under consideration. Also, each successive round of spending includes a different group of industries (depending upon the different composition of goods and services required for production by each industry) and will therefore have a different local sales and income proportion.

One method of measuring the sum of these complex interindustry relationships is through input-output analysis. Each of the regional input-output tables used for this project are based on a tabulation of one year's interindustry sales and purchases (1967 and 1974 in this case). These regional purchasing patterns are assumed to be typical; that is, each new unit of an industry's output is expected to require a mix of goods and services

similar to the requirements of all goods produced previously. For this reason, regional multipliers derived from input-output tables are termed average sales and income multipliers.

B. Why Multipliers Differ Among Industries

The relative magnitude of each sector's sales and income multiplier depends primarily on the proportion of each sales dollar spent within the region. The particular mix of goods and services also influences the size of regional multipliers. For example, the sales and income multipliers for regional transit operations are relatively high because a large portion of each transit revenue dollar is spent on wages and salaries.

The transit multipliers developed for this project also appear high because of certain public enterprise accounting conventions. Since these sectors were developed directly from published annual transit operating budgets, these multipliers represent the change in local economic activity induced by a one dollar increase in the transit agency budgets. For this reason a large proportion of each transit budget dollar is spent directly on goods and services.

Household income is also spent on many local goods and services, which contributes to the large multiplier effect in this analysis (3.187 for BART and 3.223 for bus transit).

In general, household income is the largest component of each regional impact multiplier.

C. Comparisons with Other Types of Impact Multipliers

As discussed in this Technical Memorandum, there are several different types of economic models which can be used to measure regional (or national) multiplier effects. Direct comparisons are difficult because each analytical framework has its own specific set of assumptions and conventions. However, in comparing the multiplier effects estimated by this project with the findings of other studies several "rules of thumb" should be observed.

The total requirements multipliers derived from the Bay Area input-output model are directly comparable with national input-output multipliers for that same year. Before comparing these two sets of interindustry models, however, the household sectors (included as an endogenous component of the San Francisco Bay model) must be removed before the total requirements multipliers are calculated. Once this adjustment was made, the regional industry multipliers were found to be 30-40 percent lower than their national counterparts. This is due to regional "leakage"

effects caused by high levels of import and export flows. In general, the larger the region, the higher the expected regional activity multiplier because a greater proportion of required goods and services can be supplied by local firms and households.

If we compare the regional multipliers which include household income effects, we find they are 40-60 percent higher than those which exclude household spending. This large household income or induced component illustrates the critical role of the regional propensity to consume (how much of each income dollar is spent on local goods and services) in determining the magnitude of the total multiplier effect.[1]

Comparisons between the multipliers developed for this study and multipliers derived from the structural equations of national and regional econometric models should be made with more caution. First of all, in a large econometric model multipliers may be derived from a nearly infinite number of interrelationships and variable combinations. In making this type of comparison, the particular multiplier which captures the effect of a change in final demand (i.e., regional public investment) upon total sales and incomes is comparable. (Since nearly all econometric formulations are time-series forecasting models, the magnitude of each multiplier will vary with the time period and stage in the business cycle.) Second, most multipliers based on econometric models reflect marginal or incremental effects (as opposed to the average impact multipliers of the input-output model). An incremental multiplier measures the change in economic activity expected from one more dollar of investment spending, whereas the input-output multiplier reflects the impact of an average or typical investment dollar.[2]

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[1] In a recent series of computer simulation experiments with several regional input-output tables, researchers demonstrated the importance of regional purchasing coefficients (the proportion of household income spent within the region) in determining the magnitude of the multiplier effect. See Benjamin H. Stevens and Glynnis A. Trainer, "Error Generation in Regional Input-Output Analysis." Regional Science Research Institute, Working Paper A1-76, Philadelphia, 1976.

[2] The suitability of using an average versus an incremental multiplier depends, of course, on the relative magnitude of the change in baseline activity being analyzed and the particular characteristics. This marginal versus average problem has been the subject of much debate by economists, though no conclusive evidence has been offered by either side. In general, average impact multipliers are somewhat higher than multipliers based on incremental changes.

Third, adjustments must be made for the particular accounting and reporting conventions used by each modeling group. For instance, most econometric multipliers are reported at "peak year" levels (a particular exogenous change in one variable may take several years to work its way through the system). input-output multipliers, on the other hand, represent total change in economic activity summed over all periods. Finally, the composition or level of aggregation of each variable must be considered for comparative purposes. For example, in the Data Resources, Inc. National Econometric Model, debt service is a component of the local government expenditure variable. In our analysis of BART's capital expenditures, however, debt service costs are not included in the regional analysis of capital expenditure impacts.